SCIENTIFIC AMERICAN

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AMERICAN STEAM YACHTS.

The Atalanta, the most famous yacht in America, was built by Messrs. Cramp, of Philadelphia, her keel having been laid there on December 10, 1883. American ship builders have long been noted for their excellent workmanship, but the skill displayed in the construction of this beautiful craft is proved by her great strength, beauty of model, finish, and speed. Her portrait is given in upper engraving.

She is of iron, 230 feet 3 inches length over all, 225 feet on deck, and 213 feet 3 inches on water line. Her extreme beam is 26 feet 4 inches, and her draught 13 feet. She is one foot longer than Mr. Bennett's Namouna, and being of greater beam is the largest in the American yacht fleet. Her lines forward give an easy and graceful entrance in the water; her run is long and smooth, finishing with an elliptical overhanging stern of the true American type, a striking feature of this most perfect boat. The entire iron plating of the outer skin is overlapped at the edges, the rivet heads being counter sunk. Above the water line the plating is carried up to the top of the bulwarks, which are rather higher than usual on yachts, the top being finished by a handsome continuous rail of solid mahogany. The hull is painted jet black, with no ornaments save a gilt eagle at the bow point and her name in gold letters on the stern.

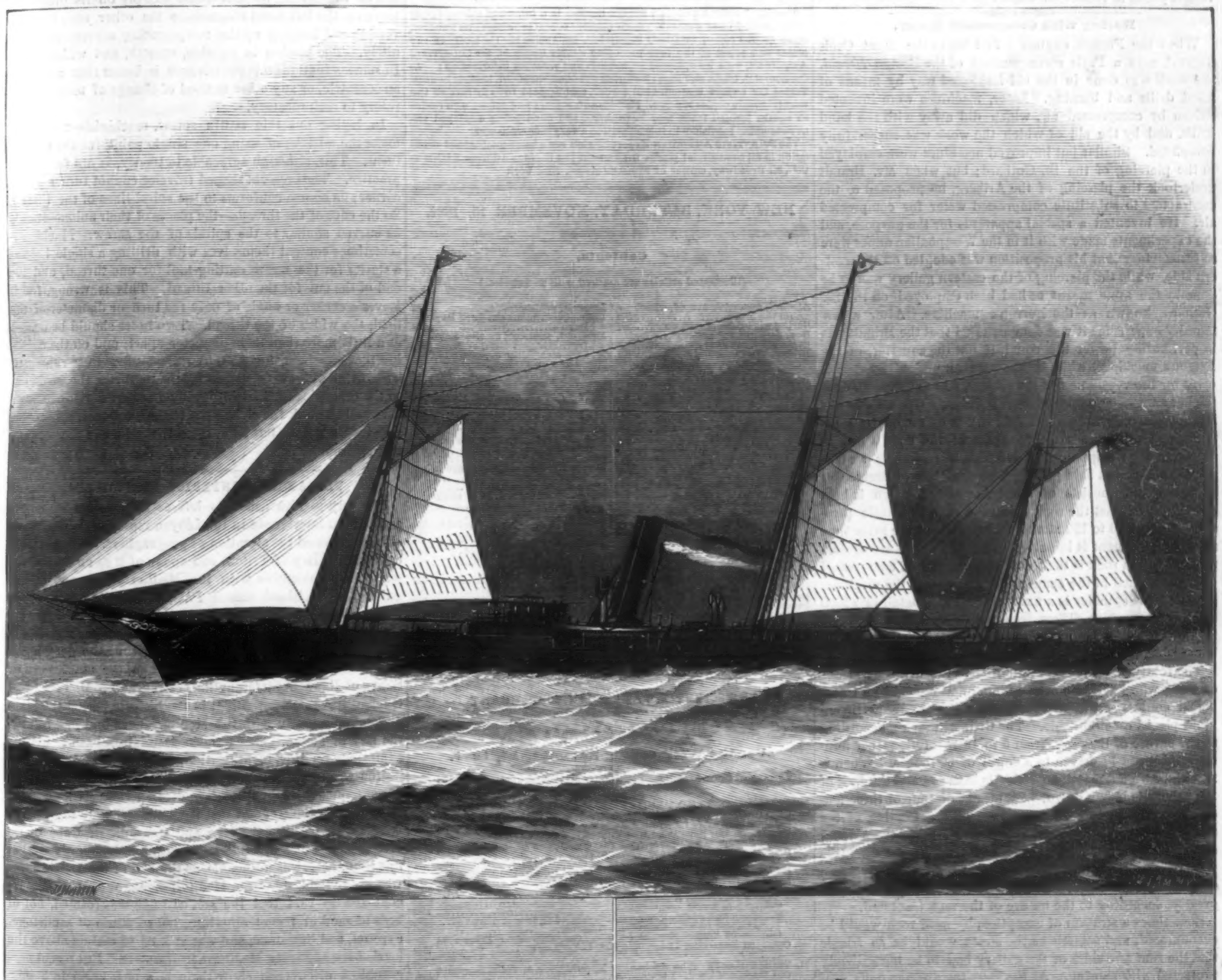
The upper deck is of iron, flush fore and aft, overlaid with a flooring of white pine. The waterways and plank sheer are of solid mahogany, the inside of the iron bulwarks being covered by a handsomely paneled casing of the same costly wood highly polished. There is a steam capstan windlass forward. The deck house is 80 feet long. Her complement of boats consists of one Herreshoff steam launch, one dingy, a six oared cutter, and a whale boat rigged as a gig.

The pipe from the galley ranges discharges into the smoke stack, which is double, having an air space of two inches between the outer and inner pipe, thereby preventing all burning of the paint.

The crew consists of a captain and two mates, four quartermasters, two boatswains, eighteen seamen, one ship engineer, two assistant engineers, three oilers, six firemen, three coal-passers, one steward, three cooks, and six cabin servants.

Her engine, a compound, inverted, direct-acting, with surface condenser, is of 1,000 horse power, with two cylinders, one thirty inches in diameter, the other sixty.

The yacht is lighted throughout with Edison's incandescent lights, and electric communication with all parts of the



WAVE LINES PRODUCED BY THE YOSEMITE. AMERICAN STEAM YACHTS.—THE ATALANTA AND THE YOSEMITE. WAVE LINES PRODUCED BY THE ATALANTA.

ship is had by electric signals, a separate engine driving the dynamo machine supplying the lighting power. Each room has a separate ventilating pipe from a main fan, also a steam coil for cold weather.

In the race of August 10, between the steam yachts of the American Yacht Club Fleet, from Larchmont, N. Y., to New London, Conn., a distance of 90 miles, this remarkable boat made the distance in 4 hours 44¾ minutes. Allowing some of her competitors one hour's start, she was first in beating the Yosemite, her especial antagonist, by 26 minutes. This latter's blowing fan broke down about the middle of the contest, but it is doubtful if without the accident she could have caught up, the Atalanta having gradually drawn away from her from the start.

The day was stormy, with strong head winds. The Atalanta was well prepared for the contest. Her load line just touched the surface. All her boats were in on deck, and her numerous crew gathered way aft at the start, when they moved forward as soon as she gathered full headway. As her propeller took hold of the water, a small mountain of water and foam rose up, almost obscuring her rail, but gradually subsided as her full speed was gained.

When under full headway, a broad sheet of foam spread from her bows, falling away amidships only to rise again toward the stern. The Yosemite on the contrary seemed to gather but little at the bow, but the swell rose amidships, and then fell away again before reaching the stern. Her disturbance of the water's surface was much less marked than that of the Atalanta, which proved herself in this contest the fastest yacht in American waters.

Boring with Compressed Water.

When the French engineers first began the Mont Cenis Tunnel, says a Paris correspondent of the Boston *Herald*, the work was done in the old-fashioned way by means of hand drills and blasting. Later, machines were invented driven by compressed air, which did away with the hand drills, and by the aid of which the work was successfully completed. Similar but improved machines were employed in the piercing of the St. Gothard; but when Mr. Brandt undertook the piercing of the Arlberg, he proposed to the contractors to substitute compressed water for compressed air. He invented a special apparatus for the purpose, and the experiments made with it in the Westphalian mines were so satisfactory that his proposition was adopted on the western side, while the piercing of the eastern gallery was to be done by the same means as had been employed on the St. Gothard, known as the Ferroux machine. After a few months' experience it was demonstrated that the Brandt was in perforating power the equal, if not the superior, of the Ferroux machines, while it possessed an undoubted superiority for the ventilation of the gallery, and consequently for the health and comfort of the workmen. When I saw the Brandt machine at work, I was struck by the contrast between its smallness and the greatness of the task it had to accomplish. In appearance and size it resembles an old-fashioned 6 pound field piece. The drill has a diameter of 30 inches, and consists of a circular auger, which is held powerfully against the rock by means of a hydraulic pressure of from 100 to 120 atmospheres, while at the same time a rotary movement is imparted to it. The pressure against the face of the rock is the result of a column of compressed water contained in the cannon-like cylinder of the machine; inside of this cylinder is a fixed piston rod, a detail in which the Brandt machine differs from all other similar drills, in which it is the cylinder that is fixed and the piston rod that is movable.

The rotary movement is imparted to the drills by means of a cog wheel acting on the cylinder and moved by a transversal endless screw, driven by two little hydrometric engines placed on either side. The drill will make, according to the nature of the rock, from 5 to 12 revolutions per minute, and it can be driven to a depth of 39 inches. When it is withdrawn a dynamite cartridge is inserted, and the face of the gallery is blown down. By means of four of these machines, a gallery 16,390 feet long, with a heading of ten square yards, was driven into the western side of the Arlberg during the same space of time that six Ferroux machines were driving a similar gallery 17,900 feet into the eastern side of the mountain. The daily rate of progress varied greatly, according to the nature of the rock traversed.

Sometimes a stratum of exceptionally hard rock would be encountered, and sometimes the strata would be so friable that the roof and sides of the gallery had to be immediately protected with shoring. At the start the average daily progress did not exceed 6½ feet, but toward the end 26 feet were the minimum, and 37 feet the maximum, of a day's work. As high as 100 cubic yards of rock were sometimes removed during 24 hours, and an average of 500 cubic yards of masonry were built per day. About 2,000,000 pounds of dynamite were used in this blast, and most of it was manufactured on the spot, in large frame buildings erected for the purpose in isolated spots at either end of the tunnel. In the construction of the gallery the same system employed at the St. Gothard Tunnel was adopted. This system consists in the establishing of a principal gallery, and of a second gallery parallel to and above the principal one. The dimensions of the former were 8 feet high by 9 feet wide, which allowed six miners to work at the same time. The upper gallery, 7 feet high by 6½ feet wide, would only permit four men to work.

OIL is now extracted from the seeds of grapes in Italy. Young grapes yield most, and black kinds more than white.

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(Illustrated articles are marked with an asterisk.)

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No. 468,

For the Week ending November 15, 1884.

Price 10 cents. For sale by all newsdealers.

THE RETURN SCREW.

To many machinists the production of a return screw for changing a rotary into a reciprocating movement is a difficult job. It is something more, to be sure, than cutting a right and left hand screw separately or independently; for the starting and finishing points of the two threads must be the same, and yet there must be no abrupt corners at either end of the screw. To produce such a dual or returning screw, the work should be properly laid out before it is attempted to be completed at the lathe.

The return screw is a right and left hand thread cut on a short cylinder, each crossing the other, the terminals meeting at some initial point. In practice it is best to have the threads square, with slightly inclined sides. The object of the return screw is to convert a rotary motion into a back and forth movement of perfect regularity. This back and forward movement can best be obtained by means of a lever, by which the ultimate throw can be limited or extended. On a return screw of only six inches length, with four turns of one and a half inches pitch, the writer once produced a practically regular and even reciprocating movement of twenty inches. The lever is moved by a substitute for a half nut that runs in the scores of the thread. Unlike any half nut, it does not reach over two threads—it engages only with one. In fact, it is a crescent shaped piece of steel, with thinned points, having a pivot at the back of its convexity, so that it may turn freely in either direction.

In action the crescent runs along the channels of the right hand thread, as the screw revolves, until it reaches the end of the screw, when it turns sharply on its pivot and traverses the left hand channels to the other end; then reversing and keeping up the reciprocating movement indefinitely. The motion is equable, smooth, and without jar. In some situations this contrivance is better than a cam or an eccentric, or any other method of change of motion from rotary to reciprocatory.

In laying out this return screw, machinists sometimes make the mistake of using one single point for the end returns. This, although agreeable to theory, is not feasible in practice. The crescent shaped traveler cannot turn a sharp corner; its course conforms to the spiral lines of the thread. So the ends of the threads—the places of their union—should be curved similar to the spirals of the screw. Machinists sometimes content themselves with drilling a single hole as a starter for the screw cutting tool for one thread, and the end of the cut for the other thread. This is wrong, for it leaves a corner or angle of only the turn or diameter of the drill, the width of the thread. Two holes should be drilled at a little more than their diameter apart, and on the finishing they can be connected by means of a little chiseling. This will give a curve just sufficient to throw the guide on to the other thread. In beginning a cut on a return screw, it is well to mark the right hand thread, and then before cutting it to mark the left hand thread; the change of gears is a trifling trouble.

THE ANCIENT INTERIOR AFRICAN SEA.

The very precise accounts left us by classic authors regarding an interior sea in the Libyan region of Africa, have always attracted the attention of geographers. The ancients called it the Bay of Triton, and spoke of it as an arm of the sea in communication with the Mediterranean, and distinguished by an island named *Phla*, which the waters alternately covered and exposed. Herodotus and Scylax give these particulars, and Ptolemy at a later date describes a river which flowed into it. For a long time the geographic world failed to locate this sea, but from the studies of Dr. Shaw, of Rennell, Sir Granville-Temple, and MM. Tissot and Guerin, it was supposed that in the historic period the lakes had communicated with the Mediterranean and had formed the Bay of Triton. Commander Roudaire, basing his assumptions on this identification, believed that this Bay of Triton was dried at the commencement of the Christian era in consequence of the formation of an isthmus which separated it from the sea, and that it would suffice to dig a canal between the basin of the lake and the Gulf of Cabe to revive this ancient sea. But later examinations proved that this hypothesis was untenable, as the bed of the Djerid Lake was above the level of the Mediterranean, and M. Fuchs recognized in 1874 that the soil of Cabe was formed, not of beds of sand or recent alluvium, but of strata of sandstone, gypsum, and limestone, and was at least 46 meters above the level of the adjoining Mediterranean waters. But recent geographical discoveries show there is a new basin in Tunis, that of Lake Kelbiah, which embraces all the central portion of the Tunisian plateau and the plain of Kairouan.

A large stream descends from Tabessa and empties into the Gulf of Hammamet, where it debouches between Sousa and Erghéla. At some distance from the shore lies the great Lake Kelbiah, which the river traverses, reappearing beyond under the aspect of a canal of exit, by which Lake Kelbiah during floods empties its surplusage of waters into the sea. M. Rouire, in the *Cosmos les Mondes*, gives some notes of a recent visit he paid to this locality. He had previously studied this region, and had published his conclusions as to its being the site of the ancient Bay of Triton, which had almost been abandoned by scholars as a real geographical locality. His essay awoke a lively discussion, and he was accused of ignorance of the ancient authors and their descriptions. A renewed careful study of Herodotus, Scylax, Pomponius Mela, and Ptolemy assured him that the position of Lake Kelbiah corresponded with its surroundings to the descriptions of these authors.

Herodotus describes the Bay of Triton, between his day and the first century of our era, a shore formed between the bay and the sea, and to the bay succeeded a lake which Pomponius Mela and Scylax describe in similar terms. All these three writers tell us that a large river, the Triton, emptied into the Bay of Triton; but they give us no details as to its source or upon the features of its course. But this gap is filled by Ptolemy, who speaks of the source of this river in Mount *Ousaleton*. In its course three lakes lie—lakes Triton, Pallas, and Libya. These details, with many others, are carefully examined and identified by M. Rouire.

"Thus," he concludes, "source, environs, and delta of the river Triton, the aspect of the country traversed, the lakes in which this stream empties before meeting the sea, all are found identified upon the environs of this new water course in central Tunis."

HORSERADISH.

The botanical name of this well known garden plant and popular condiment is *Armoraciæ radia*, a native of western Europe. It is remarkably tenacious of life, and spreads itself without artificial aid, coming up sometimes at long distances from the parent plants in soils adapted to its growth. The root contains an acrid oil similar to, if not identical with, that of mustard, and to the pungent flavor of this oil is due the desire for grated horseradish as a condiment. It is considered medically as a harmless stimulant, of use in dyspepsia, and a sirup prepared from the root is used in colds and rheumatism.

In some cities, the horseradish is grated at the doors of the customers; or dealers stand at the street corners, and grate from the heaped roots a gill, half pint, or more at the call of the customer. All this work is done by hand, and is intended to counteract the popular idea that turnip forms a large part of the bottled horseradish. This is not so, for the turnip would turn the horseradish black, or discolor it, and, besides, it costs hardly more to raise horseradish than to raise turnips. The absolute whiteness of horseradish (except the color of the vinegar) is a necessity to its commercial value. This whiteness cannot exist in adulterated horseradish. In the manufacture of the grated horseradish in large quantities the graters must be made of white metal or of sheet tin, as the contact of uncovered iron would blacken the product.

The cultivation of the root is simple. At the harvest, in the autumn, those roots which are too small for commercial purposes—less than a pipestem in diameter—are packed away in sand in short lengths of from four to six inches. In the spring these are planted in plowed furrows by means of a hand dibble, making a hole to plant the slip in, upper end just below the surface. It grows with the commonest cultivation—field cultivation—and is harvested by the plow and the potato digger.

In preparation for the market the roots are freed from sand or soil, and are scraped by hand until every discolored portion is removed. The cleaned roots are then put into a tumbling barrel with water, and thoroughly washed. To be ground, they are fed into a hopper over a cylindrical grinder of white metal with its corrugations like those of a nutmeg grater, and held down to its surface by the weight of a block of wood fitting, like a piston, the sides of a rectangular box into which the hopper leads. The grated root is mixed with vinegar, bottled, and sealed immediately. And herein is the trouble about adulterated horseradish. Exposed in a grated form half a day, the horseradish is tasteless; the aroma goes with the air like a whiff. Nor will dry horseradish retain its strength. Horseradish is like the rose; it must be smelled—or tasted—immediately on its ripening, or it is "scentless and dead."

An Artesian Well in Nevada.

A very deep well is being sunk at White Plains, Nevada, on what they call the 40-mile desert, in the neighborhood of the sink of the Humboldt. The well is being put down by the Central Pacific Railroad Company as a test well, not alone for the satisfaction of obtaining water for their own use, but to determine the feasibility of getting it elsewhere on the line of their railroad, as well as in other parts of the State. The only good supply of water for the desert is brought from the Truckee River, 35 miles west of the new well on White Plains, and is hauled in tank cars for the supply of engines and domestic purposes, showing the necessity of testing thoroughly by artesian wells to get water. The desert contains many specimens of Indian curiosities—arrow heads, Indian mortars, etc.—being formerly fine hunting grounds.

A record of the progress of this well will be of interest to many persons. They have found salt water, hot water, and finally at a depth of 1,650 feet, they came across wood. Mr. W. C. Chapin, who has charge of the drilling of the well, sent to the Academy of Sciences samples of the wood brought up by the drills, and gave a brief record of the material passed through in boring.

From the surface to 20 feet they passed through clay with a four inch stratum of fine decomposed quartz; then to 36 feet it was tufa and cement; then two feet of cobbles, sand, and hard shells. At 38 feet they struck a strong stream of salt water in gravel; from 40 to 70 feet there was sand, cement with seams of rock, and cobbles. This kept on until they reached 144 feet, when they met cement clay, with sand and gravel, which continued to 205 feet, when they met fine brown sand; then down to 300 feet there was cement, gravel, sand, and shell conglomerate. From 300 to 340 feet, compact sand or sand rock; to 367 feet, various kinds of cobbles; then followed white tufa, fine sand, cement, sand, and gravel to 400 feet. A stratum of conglomerate was then found, which passed into cement at 420 feet, where cobbles and gravel were met with, and then fine sand; at 486 feet bedrock was found. Eight inch driving pipe was driven to the depth of 486 feet, the part above this being all surface wash. From 486 to 520 feet was black rock, when red volcanic rock was met, continuing with slight change to 575 feet, where black basalt was found. At 595 feet there was red rock and red mud; then came black rock with seams of clay. From 625 to 635 feet there was a reddish-gray rock with cement, which mixes up with the water—red rock probably from above. Gray muddy rock then came in, and from 655 to 665 feet a reddish-brown sand rock; then a soft green rock. Between 666 and 685 feet there was very compact black sand, and then hot water was struck.

Between that point and 697 feet was reddish-black sand, changing to coarser below, when at 703 they found red rock again, which continued to 745 feet. From there to 950 feet was black, red, and gray rock, in strata. From there to 1,000 feet, and to 1,040 feet was red rock, fine and very hard. From 1,040 to 1,050 the rock was slate-colored. From that to 1,140 black (basalt), and then a red slaty clay, followed by blue clay (slate) and volcanic ash. The volcanic ash continued to 1,300 feet, when conglomerates and rock were met, lasting to 1,550 feet, when a soft, muddy, white rock came in, continuing to 1,610 feet.

From 1,610 to 1,615 feet was a fine gray sand, and from 1,615 to 1,624 was a stratum of *wood*. This wood is not silicified, but is black and hard, though it breaks readily when handled. Some large pieces were found. It is rather remarkable to find wood at such a depth, and so thick. Iron pyrites were found near by. Below this, again, is conglomerate, with some fine sand. At 1,825 feet very muddy rock came in, and also more sulphurets, followed by a soft, dark rock, very loose, and falling in on the drills. From 1,890 to 2,088 feet very hard black rock was met. The well is now down over 2,100 feet, but no water has yet been found, aside from that which is hot or salt, as mentioned.

The work of sinking is, however, being continued, with the hope of eventually striking a flow of water.—*Min and Sci. Press.*

The Effects of the Excessive Use of Alcohol on the Mental Functions and Brain.

Dr. Clouston, of the Edinburgh Asylum at Morningside, the noted author and specialist, in a recent lecture on this subject writes as follows:

The effects of a single dose of alcohol differ widely in different individuals, and this lies at the root of all scientific inquiries into the matter. The variety of the effects on the mental faculties of different brains is also extreme. This indicates such different qualities and susceptibilities in different brains as regards this agent, that it makes the whole question of the effects of alcohol a most complicated one, not to be explained by a few unqualified assertions. In reply to the question, What are the normal effects of alcohol on the mental forces of the brain? the scientific man must reply, What kind of brain do you mean? And it is only by a careful study of the qualities, the tendencies, and potentialities of different brains, that we can answer the first question properly. We need to study the mental qualities of the brain at different periods of life, in the two sexes, in different temperaments and constitutions, in different races, in different states of health and vigor, and with reference to the hereditary tendencies of the organ; for all these things influence the effects of one single small dose of alcohol. So we find, looking from the point of view of the amount of the doses, the effect is very different. There is, I believe, no other agent known which differs so greatly in different instances in the dose needed to produce the same effect on the mental powers as a dose of alcohol, and herein again we find that there must be the greatest difference in the power of resisting the effects of alcohol in different brains. Taking the lower animals, that difference is exceedingly small; an ounce of alcohol given to a dozen dogs of the same size will practically have the effect on them all; but an ounce given each to a dozen men has not only the most different effect in the mental faculties it stimulates, as we have seen, but in the *amount* of the effect it causes. Some brains are exceedingly sensitive to very small quantities; other brains have the power of resisting or tolerating alcohol in a wondrous degree, this being an innate quality quite apart from the effect of the use and custom. These differences are so great as to compel us to conclude that there are enormous inherent disparities in human beings in this respect, and this is no doubt one of the very great dangers in the use of alcohol.

So we also find at the various periods of life, ordinary small doses of alcohol have very different effects. In a child the effect is extremely great; in a boy or girl it is also great, but it is not so great in a growing adolescent. In the two sexes there are also considerable differences, the female having less resisting power, her brain being usually much more susceptible to the influence of this agent. Looking at different races, the difference of effect of the same dose is also extremely great. There are some savage races that are so subject to its influence that a very small dose indeed—half an ounce—will have greater effect on them than two or three ounces will have on an ordinary European. The psychological, the mental, effects of small doses of alcohol are therefore exceedingly various, and we have not yet discovered the precise qualities of brain which caused these differences. We cannot tell beforehand which brain will be susceptible to its effects, and which will not. Looking at the matter next from a point of view of the effects of a much larger dose, these will be found much more uniform. The effect instead of being stimulating is then narcotic, and we have a deadening, paralyzing, and temporary arrestment of the mental functions of the brain in every individual if a sufficient quantity is taken. But here we find much variety in the way the result is arrived at, when carefully studied.

In one person we have this paralysis, this deadening, taking place first on the intellectual faculties, in another on the emotional, in another on the propensities, and in another on the power of motion. We see a certain kind of mental degeneration of a slight type, which results in those who habitually take an amount of alcohol that is to them excessive. This slow but quite marked type of mental degeneration a doctor of experience soon comes to observe in his patients; and others a certain change mentally, morally, and bodily, in the man who is taking more than is good for him. The expression of his face and eyes—those mirrors of the mind—you see has changed, and for the worse. The mental condition of the man is lowered all round, and especially one effect is noticed, that his higher power of control is lessened. I am safe in saying that no man indulges for ten years in more alcohol than is really good for him without this kind of degeneration being observed, and that although during these ten years he was never once drunk we find him psychologically changed for the worse in his independence of mind, in his spontaneity. After a man has passed forty, such changes are very apt to be faster, and more decided. We see such a man's work and his fortune suffering, but we dare not call him either a drunkard or dissipated, because, as a matter of fact, he has never been drunk, and never intends to be drunk. Whether this degeneration takes place soon or late depends upon inherent resistive capacities of his brain cells. In some individuals the resistive capacity against alcohol is so great that for years they may indulge in its excessive use without this degeneration taking place to any great extent, but in other instances we have it very rapidly developed indeed.

Some men pass into a premature old age and become old at fifty, when they ought to have lived on and been young men up to sixty, and this merely owing to the excessive use of alcohol. Memory and the power of thinking are affected, but you see the lowering most in the finer faculties, the tastes, the more delicate perceptions of things, and the force of character. This is an effect which, I believe, is especially to be observed in men who have used their intellectual powers constantly and vigorously. We often see this effect on the brains of men in our profession of medicine, at the bar, and even among the clerical profession, in a very marked degree, without their owners having been once drunk. In such persons, their mental powers having been greater to begin with, and with a finer edge on them, you notice in a more marked way this degeneration in its progress. This, I may say, is the least marked mental effect of alcohol taken, not so as to produce drunkenness, but taken in greater quantity than the physical constitution of the brain can stand over a long period. In some brains a very small quantity indeed, taken daily, will produce this degeneration.

Mechanical Properties of Galvanized Iron and Steel Wire.

At the wire mills of Witte & Kaemper, a series of tests has been made to ascertain the mechanical properties of galvanized steel and iron wire, with the following results:

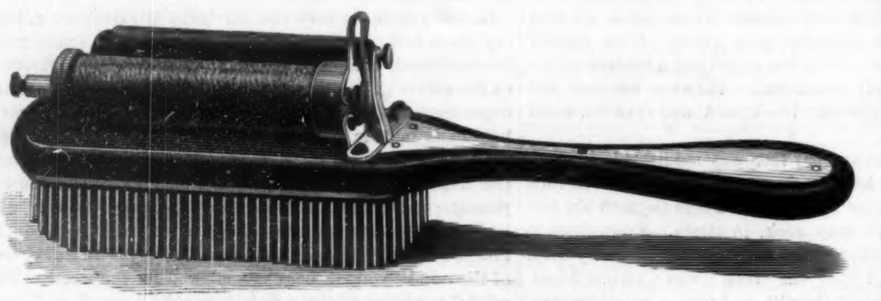
	Steel.	Iron.
Diameter, inch	0·16	0·161
Tensile strength per wire, pounds	2447	1845
Elongation, per cent	5	15

A torsion test made showed that on a length of 11·81 inches the steel wire could be twisted four times before it broke, while the iron wire stood 18 revolutions. For the tensile tests, the length of specimen was 5·96 inches. The galvanized steel wire is used for wrapping ocean telegraph cables, while the iron wire is used for surface telegraph lines. The steel used is generally made by the Bessemer process, while the iron was puddled from a mixture of Westphalian mill pig, Siegen charcoal pig, and pig from the Georg Marie Hütte at Osnabrück. The quality of the galvanizing is tested either by dissolving the coal in hydrochloric acid or by dipping the specimen a number of times for a given time for each immersion in a solution of sulphate of copper. The wire must not show any signs of a deposit of copper. For the German telegraph service, the sulphate solution is a mixture of one part of sulphate and five parts of water, and the wire must undergo five immersions of a minute each. For the steel cable wire, the specification is a tensile strength of 53 tons per square inch, an elongation of 1·5 per cent., and a bending test of wrapping the wire twice around a piece of wire having the same diameter and straightening it out without breaking it.

THE Louisa County (Va.) pyrites are to be very favorably exhibited at the New Orleans Exposition, in the collection of the National Museum. Samples of massive pyrite, both copper and iron, from veins thirty-seven feet wide, will open the eyes of foreign visitors to resources of this country.

AN ELECTRIC HAIR AND FLESH BRUSH.

Upon the back of the brush, shown in the engraving, are placed a small battery and an induction coil. The ebonite cell is held between contact springs at each end, and is provided with a screw plug which is inserted in one end when the battery is not in use; but when in operation this is replaced by a plug carrying a bar of zinc. The current of electricity generated by the battery—the exciting fluid of which is bisulphate of mercury—is led to the induction coil, where the strength may be diminished or increased by a tube that slides in and out of the coil. One wire from the coil leads to a metal plate attached to the back of the handle, and the other leads to a plate in contact with bristles, which are made of a suitable conducting material. When the brush is grasped in the hand, the current passes through the body to that point which is in contact with the bristles.



AN ELECTRIC HAIR AND FLESH BRUSH.

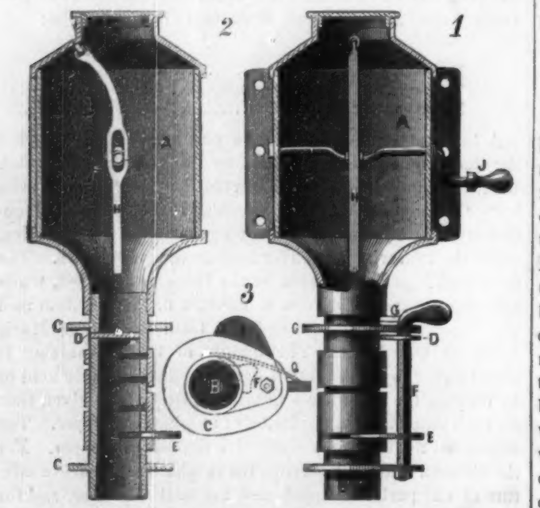
The many applications of this brush will be readily perceived; it may be used as a hair brush to relieve neuralgia, headache, and diseases of the scalp, and it may be applied to the body to alleviate suffering caused by rheumatism, paralysis, gout, etc. As it is an electric brush in fact as well as in name, it is applicable in all cases in which the ordinary medical battery is found serviceable.

Full particulars and catalogues may be obtained by addressing the Harbach Electric Department, 809 Filbert Street, Philadelphia, Pa.

IMPROVED MEASURING CANISTER.

The canister is provided with a conical top having a central collar, to which the cover is fitted. The rear side is formed with flanges, Fig. 1, for supporting the canister in position for use. The lower end is connected with a bell-mouthed spout, to the end of which is secured the measuring tube, B, having two flanges, C, in which the square shaft, F, is journaled. A transverse slot, D, cut half way through the tube near the upper flange, receives a valve attached to the shaft. In the side of the tube opposite this slot are formed other slots (as shown in Fig. 2) for receiving the valve, E, which is also attached to the shaft. This valve may be moved along on the shaft so as to enter any one of the slots, and it is so placed on the shaft that when the valve, D, is pushed in the tube the valve, E, will be removed, and *vice versa*. On the tube are sleeves provided with slots that may be adjusted so as to coincide with, or close, the slots in the tube. A spring, G, attached to the side of the tube bears against a lever on the upper end of the shaft, and tends to turn the shaft so as to force the valve, D, into the tube. A stirring bar, H, is pivoted to the upper part of the canister, and is connected to a crank shaft, J, as indicated in Fig. 1.

The canister may contain grain or other material, or it may be connected with a grain spout, when it will be employed for measuring rather than storing. The quantity of the material measured is determined by the space between the valves, the operation of which will be readily understood.



CHURCH'S IMPROVED MEASURING CANISTER.

Further particulars may be obtained by addressing the inventor, Mr. George S. Church, or Mr. C. W. Thompson, P. O. box 130, Baldwin, Mich.

THE average wages of the French miner, including women and children, was in 1882 72 cents per day; in Belgium, 59 cents; and in Silesia, 52 cents. In certain parts of France, notably the basin of the Loire, they are about 82 cents a day.

A Curious Catch.

The writer a few days ago had occasion to set a trap, one of the round wire kind, to catch a mischievous large rat, which had been seen scampering around the cellar for some time.

Fruitless had been the attempt to catch the troublesome fellow, with a variety of tempting bait, when it occurred to the writer that by partially covering the trap with a cloth, possibly the cunning of the rat might be overcome. The experiment was tried, and a saucer of oatmeal from the breakfast table was placed within the trap. The next morning what appeared to be a roll of rags was found inside the trap, which on opening it was found to conceal a large sized ground mole, who, on being shaken out of his covering, commenced eating the oatmeal, with apparent relish. How the mole found his way into the cellar is an unsolved mystery, but that he was attracted into the trap by the meal is an indisputable fact, and that ground moles do eat cereal food can be no longer denied. The habits of the mole have interested both the naturalist and the gardener, and considerable discussion has arisen upon the subject of their diet, some contending that they live entirely upon worms, and others that their nourishment is derived solely from the roots of grass, while it is probably the fact that they partake of both, as they come in their way, and can grow fat upon either, for whoever saw an attenuated mole!

IMPROVED VEHICLE TOP.

The top is formed on bows, on which strips are secured, to which in turn the roof covering is fastened. On the front and rear surface of each side standard of the bows are secured plates, the edges of which project so as to form grooves. Guide rods pass up through the grooves and are bent parallel with the bows and top, and have their upper ends secured to strips attached longitudinally to the bottom edges of the bows; these strips are arranged in different horizontal planes, so that the rods on opposite sides of the top will not interfere with each other. The curtains are provided with linings and between the side edges of the curtains and the linings are held strips on which clips are secured. The rods pass through eyes formed by these clips. Between each two of these clips are secured other clips, which cover the outer edges of the strips. (This construction is clearly shown in Figs. 2 and 3.) Upon the bottom edge of each curtain is a stiff piece, in the middle of which is a handle by which the curtain is moved. A cross piece made of sheet metal is held between the curtains and linings at about the middle, and another at the top. When the curtains are moved upward, they slide on the curved parts of the rods and their inner ends overlap. The curtains are held in any desired position by the friction of the eyes on the rods.

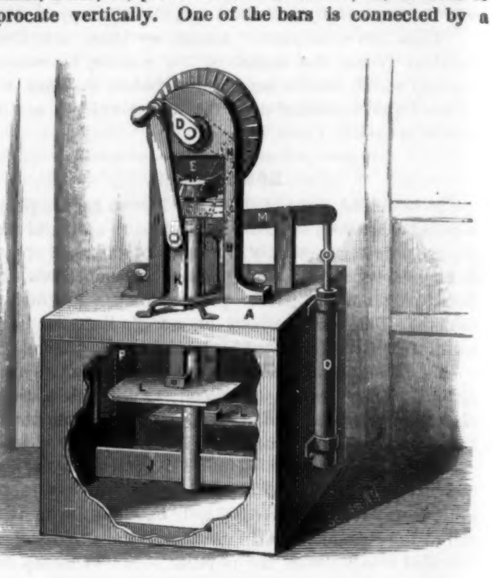
This invention has been lately patented by Mr. Thomas B. McCurdy, of Lancaster, Texas.

The Phylloxera.

M. Balbiani, professor at the College de France, was commissioned a short time ago by the Minister of Agriculture to report upon the best mode of destroying the winter eggs of the phylloxera, as it has been found that it is in this way the progress of the parasite is very materially checked. M. Balbiani reports that three methods have been employed—the mechanical destruction of the eggs by barking the vines, boiling water, and rubbing the vines with preparations calculated to burn up the eggs. The first named of these methods has been tried in several vineyards near Bordeaux, the workmen rubbing the stocks with a chain steel glove, but the results are not satisfactory, as it is only the old wood which can be treated in this way. The use of boiling water would produce excellent results but for the fact that it is open more than any other process to carelessness in application, and that neutralizes all its good effects. The rubbing of the vines with a preparation composed of nine parts of coal tar to one of oil was open to the objection that the coal tar got so thick in cold weather that it could not be applied, and the cost of heating it again was considerable. Several vine growers tried to liquefy the mixture by adding 15 per cent of turpentine, but this, when applied, killed the vines altogether. M. Balbiani tried several fresh experiments, among others a mixture of oil, naphtha, quicklime, and water. This mixture has been tried upon a very large scale in the vineyards of the Lot-et-Garonne and the Loire-et-Cher, and it possesses, according to M. Balbiani, the double recommendation of being effectual and cheap, as the cost is under a franc for a hundred stocks.

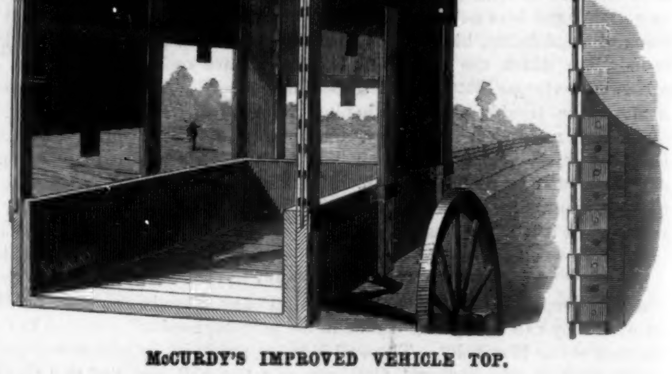
AN IMPROVED CHURN.

On top of the cover of the cream box is a two-legged standard, B, detachably secured by two thumb-screws, C. In the top of the standard is journaled a shaft, on one end of which is mounted a beveled wheel, E, and on the other a crank, D, furnished with a handle. The beveled wheel engages with a pinion, H, mounted on the upper end of a vertical shaft journaled in the bottom and in the top of the box, and on the lower end of which are wings, J. On each side of the shaft, a bar, K, provided with a dasher, L, is held to reciprocate vertically. One of the bars is connected by a rod to the crank, D, and the other is connected to a wrist pin on the beveled wheel. Joined to the wrist pin is a bar connected with the lever, M, to one end of which is attached the piston rod of the pump, O; the bottom of the cylinder of the pump communicates with the interior of the box. Secured on the inner surface of the box is a wire netting receptacle, P, for a thermometer. When the shaft is revolved, the beveled wheel revolves the pinion, H, and shaft, and the dashers are reciprocated. At the same time cold air is pumped into the box; the pump can be disconnected when the cream becomes cool enough. When the churn is to be emptied, the entire working mechanism and standard carrying it can be disconnected by loosening the screws, C.



CLARK'S IMPROVED CHURN.

This invention has been patented by Mr. John W. Clark, of Banksville, Pa.



McCURDY'S IMPROVED VEHICLE TOP.

Uses of the Passion Flower.

According to Dr. George W. Winterburn, the therapeutic uses of the white passion flower resemble the bromides on one hand and gelsemium on the other. It is one of our best hypnotics, producing a quiet, pleasant sleep altogether different from the comatose stupor of morphia, and from which the patient may be aroused at any moment. It may be given in doses of two or three drops of the tincture or low dilution. Even in the worst form of sleeplessness, that associated with suicidal mania, this drug will produce quiet slumber, from which the patient awakens with clear mind and rational thoughts. In its control of convulsion, passiflora closely resembles gelsemium. It will be found of service in opisthotonos, trismus, and tetanus.—*Amer. Homœopath.*

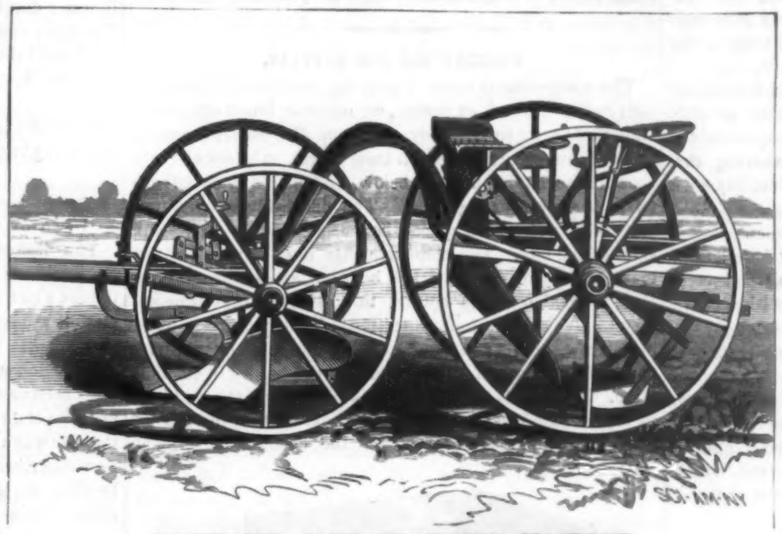
Keep Out the Cold.

Cracks in floors, around the mould board, or other parts of a room, may be neatly and permanently filled by thoroughly soaking newspapers in paste made of one pound of flour, three quarts of water, and a tablespoonful of alum, thoroughly boiled and mixed. The mixture will be about as thick as putty, and may be forced into the cracks with a case knife. It will harden like papier-mache.

CANE PLANTING MACHINE.

The accompanying engraving shows a cane planting machine recently patented by Mr. C. C. Coleman, of Honolulu, Hawaiian Islands. The machine is constructed with a double mouldboard plow to open a furrow to receive the seed. The beam of the plow is made short and curved forward, and is pivoted to the rear end of a lever, the forward end of which is pivoted to the rear part of the tongue, to support the draught strain upon the plow. A series of levers connected with the plow are operated by a hand screw, by the turning of which the plow can be adjusted to enter the ground to any desired depth, and can be raised above the ground for convenience in turning around and passing from place to place. To the center of the forward axle is pivoted the end of the reach, which is made in three branches, which are arched to give the wheels a free movement in turning; the rear ends are secured to a frame rigidly attached to the axle. To the forward middle part of this frame is attached a casing, to the front and rear sides of which are journaled two rollers placed a little distance from each other, and parallel with the length of the machine. In each roller are rows of spikes of sufficient length to take a piece of cane from the lower edge of the inclined feed table, carry it over, and drop it into the casing. To the lower edges of the tables are secured guide bars, which are curved to fit against the rollers to prevent the pieces of cane from dropping down at the outer sides of the rollers, while allowing them to come so close to the rollers as to be taken up successively by the spikes. To the lower part of the casing is hinged a tapered spout, the lower end of which follows along the furrow and deposits the cane. The pieces may be placed parallel with the furrow, or crosswise, as may be desired. The casing and spout are divided into two compartments by a partition, so that the pieces from the rollers will pass separately to the ground. Beveled gear wheels on the forward journals of the rollers mesh into gear wheels on a shaft, which is revolved by an endless chain passing around a chain wheel on the hub of one of the rear wheels; the seed dropping rollers are thus operated by the advance of the machine. The pieces are covered by covering plates attached to standards, the pitch of which can be readily adjusted; these plates can also be adjusted at a greater or less distance apart. The plates are held securely in any position by means of a lever projecting upward across an arched catch bar. To the ends of the sliding shaft that carries the lever and covering plates are fastened the ends of a chain passing around wheels mounted on vertical shafts held in bearings on the axle. By turning these wheels the shaft may be moved longitudinally, thereby giving a lateral movement to the coverers, to adjust them in relation to the furrow.

Further particulars regarding the construction and working of this machine, or the terms upon which it may be manufactured, can be had by addressing the inventor.



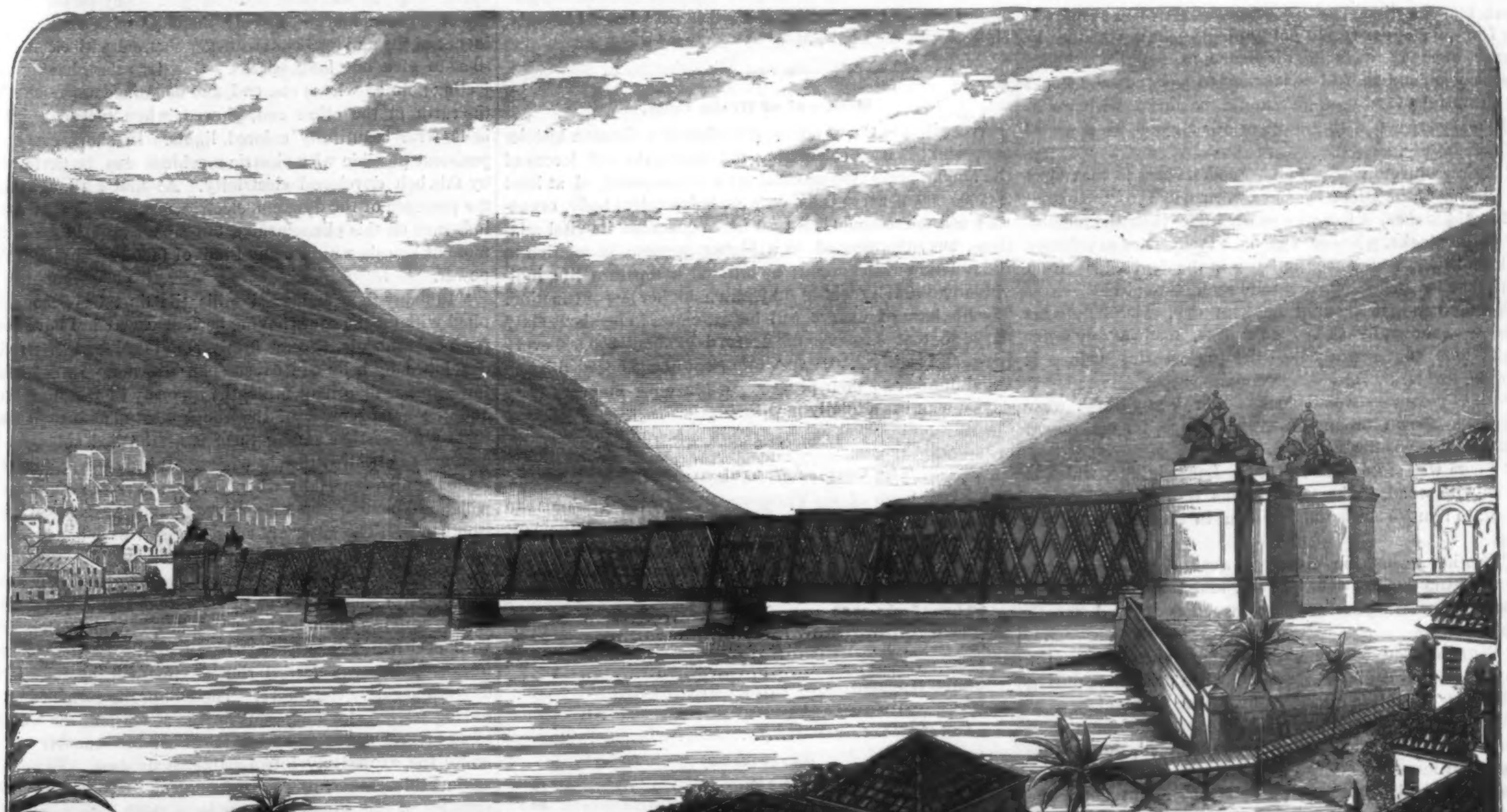
COLEMAN'S CANE PLANTING MACHINE.

A Protracted Lawsuit.

The famous chancery suits of England, of which everybody has read, sink into insignificance compared with the length of time a suit has been progressing in Northern Europe. The Supreme Court of the Duchy of Brunswick has just given final judgment in a suit of, perhaps, unprecedented duration. It was an ejectment suit by Count Stolberg against the Brunswick Government for possession of the county of Blankenburg and its domains, the market value of which was estimated at many hundreds of thousands of pounds. The original suit was commenced in the year 1604 in the Imperial Chamber of Wetzlar, which was the Supreme Court for settling disputes between sovereign princes of the German Empire. It dragged on through various stages till 1649, when judgment was given, and then it fell into abeyance. Subsequently the county, with its appanages, came into the possession of the Dukes of Brunswick. The object of the late proceedings was to revive this suit, for the purpose of declaring Count Stolberg entitled to the title and domains. The court decided finally against his claim.

IMPERIAL DOM PEDRO II. BRIDGE.

The engraving we give illustrates a bridge, in the design and construction of which are features of an essentially practical character. This structure was designed by Mr. James Cleminson, Mem. Inst. C. E., for the threefold purpose of carrying the Brazilian Imperial Central Bahia Railway, to form a public highway, and lastly a foot bridge across the Paraguassa River, between the cities of Cachoeira and Sao Felix, Brazil. The principle that has been observed by Mr. Cleminson in designing and carrying out this work is the elimination of all skilled labor, by utilizing the material just in the condition that it leaves the rolling mill, and its treatment throughout by machinery only. Our engraving is from the *Engineer*. The inception of the work is due to Mr. Hugh Wilson, C. E., and is being carried out under the approval of Mr. A. L. Stride, M. Inst. C. E., the consulting engineer of the Brazilian Imperial Bahia Central Railway Company.



IMPERIAL DOM PEDRO II. BRIDGE.

Comparative Results of Homœopathic and Allopathic Treatment of the Insane.

In an editorial published last month, we gave the results of treatment in the Middletown (N. Y.) Homœopathic Asylum for the Insane as compared with the results in the three similar asylums of the State of New York under the charge of allopathic physicians. In calculating the relative percentages, we inadvertently used the wrong column of figures from the report of the State Board of Charities, and consequently made the percentage of recoveries seem much lower than it really is. The recoveries are calculated from the number of *admissions*—the only correct method—and the deaths from the total number of inmates treated. The correct statement is as follows:

Three allopathic asylums: Recoveries, 25·37 per cent; deaths, 6·49 per cent.

One homœopathic asylum: Recoveries, 40·59 per cent; deaths, 4·39 per cent.

In other words, homœopathy cures forty patients in each hundred, while allopathy, under similar influences and with equal facilities, and treating similar cases, cures twenty-five in each hundred. While homœopathy loses by death 4·4 per cent, allopathy loses 6·5 per cent. As there were 946 patients admitted to the allopathic asylums during the year, it follows that about 142 unfortunates either died or were permitted to lapse into hopeless, chronic insanity who, under homœopathic treatment, might have been restored to health, and returned to their friends and to usefulness. Had the relative percentages of recoveries been reversed, the State Board of Charities would have recommended the immediate discontinuance of the homœopathic institution.—*Hahnemannian.*

Cremation in Italy.

The municipal council of Florence, in its spring session, May 9, 1884, at the request of a committe for cremation, has allowed 200 square meters to be occupied in the Trespiano Cemetery for that purpose. The Florentines seem to look upon this method of disposing of their mortal remains with some favor.

Trial of a Car Coupler.

At the car shops of John Wood, Jr., Conshohocken, Pa., some of the Reading cars have lately been fitted with the self-acting coupler invented by G. W. Curtis—patent of November 9, 1880. The invention has proved on practical trials to be eminently successful.

Wood Pavements.

As containing data and deductions of general interest, we publish a letter written recently by Joseph P. Card, of St. Louis, to O. Chanute, C.E. While the fact that the writer is the president of a wood preserving company should be given due weight, it should be also remembered that he is an expert in this line of practice, and has diligently studied all the bearings of the case from a business as well as a constructive standpoint:

"In the first place, "says Mr. Joseph P. Card," it is admitted by all, that it is of little use to lay any pavement without a good and substantial foundation, and none of the substances used requires this more than wood.

"Such being the case, a substantial concrete foundation is first laid, and it should cost the same, whether granite, wood, or other material be placed upon it; consequently the only thing to be considered is the cost of the wearing surface, the lasting qualities of same, and its desirability as a pavement when completed.

"In my opinion, the trouble with wood pavements in this country has been: First, the lack of a proper foundation. Second, the people generally have expected a wood pavement, which should have cost as usually laid (with a board foundation) $1.35 per square yard, to last as long as a granite pavement (with a concrete foundation) that cost $4.50 or more per yard.

"Now we will take Broadway, New York, for instance, which is 44 feet wide, with a concrete foundation, ready to receive either granite or wood blocks, and suppose granite blocks are laid at a cost of say $3.60 per square yard, which would be equivalent to $8.80 per front foot for the abutting property.

"On the other hand, a preserved wood block pavement is laid with blocks say 3½ inches by 5 inches deep, leaving a space of ¼ to ⅜ of an inch between the rows, to be filled with suitable material, at a cost of $1 62 per square yard, or $3.96 per front foot.

"Now what would be the result? The granite pavement would probably last 10 to 15 years with slight repairs, and the wood pavement 5 to 6; but for comparison we will suppose the granite to last 15 years and the wood 5.

"The granite costing $8 80 per front foot, the wood $3.96 for 5 years or $11 88 for 15 years (allowing two renewals), and deducting 79 cents difference in interest at 6 per cent, would make wood cost for this period of time $11.09 per front foot, or a difference of $2.29 per front foot, equal to 15 cents per front foot per year more than granite, which is virtually nothing.

"Now, in my opinion, the wood pavement would be more likely to last over 5 years than the granite to last 15; but if I am incorrect, who is there living or doing business on a street like Broadway, where property is worth thousands per front foot, that would not willingly pay the slight difference, or many times the difference, to get rid of the incessant noise and confusion incident to a stone pavement?

"I think the thoroughfares should be paved with wood, and the by-streets with granite or other stone, as it would last indefinitely.

"My reason for using a 5 inch wooden block is, that when the surface of the street becomes worn down to the extent of 2 to 2½ inches, it becomes so irregular that the remainder of the blocks, whether 2½ or 5 inches, are so softened with moisture, which accumulates in the depressions from rainfall or by sprinkling, that they soon go to pieces.

Wood on end, if it could be kept dry, would outwear granite, as shown by Col. Flad's tests, made at our water works here, consequently the drier the wearing surface is kept the less wear.

"Fully creosoted wood blocks under heavy traffic wear rapidly, as shown on the Brooklyn bridge, for the reason that the oil keeps the fiber soft.

"There was more wear on the St. Louis bridge, which is paved with wood, in the two months that the bridge was salted, to remove slush and ice, than in the balance of the year.

"In other words, the principal wear of any wood pavement occurs during wet weather, and the aim should be to keep the wearing surface of the wood as dry and smooth as possible.

"With a good concrete foundation once down, the wooden blocks could be renewed, when necessary, during night time, with little or no inconvenience to travel.

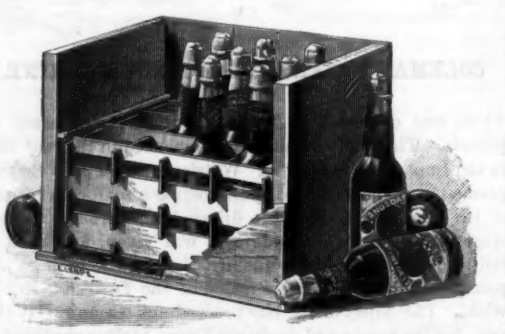
"From a sanitary point of view, the concrete foundation would prevent what most people seem to dread, the leaking through of impurities to the soil beneath, while the treated blocks would disinfect any portion that might enter the same."

Ivy Lawns.

Ivy lawns are known to but few among the many who are interested in gardening economy. They consist, as the name implies, of ivy only, and they offer some peculiar advantages in cases where grass lawns are apt to occasion more trouble than they are worth. According to the *Farmers' Gazette* (Dublin), an ivy lawn may be well made in one season, and if the primary operation of planting be properly performed the lawn will make itself; it will want no cutting, no sweeping, no watering, no protection from the birds that eat the grass seeds to-day and to morrow scratch up the tender plants, as though it was their mission to make grass lawns impossible. And when made, being, as it were, self-made, an ivy lawn will take care of itself for any number of years; but if in need of repair or trimming, the knife, the shears, or the spade may be used with unskillful hands, and with the least imaginable cost of time, for it is not an easy thing to kill, or even to seriously injure, a lawn consisting of ivy solely. Such lawns are unfit for games, and indeed should not be trodden on. They will not therefore supersede grass in a country garden, which perhaps is a matter for gratulation; but they will give us the most delightful breadth of verdure in thousands of places where grass is more plague than profit, and, at the very best, tends rather to disgrace than adorn the position.

PACKING BOX FOR BOTTLES.

The compartment crate or packing structure is formed of thin strips of wood, or veneer, arranged in longitudinal and transverse rows successively one upon the other, the strips in each row being notched on their edges to interlock with those immediately above or below, and spaces being left between the rows for lightness. The ends of the strips project to leave clearance spaces between the outer strips and sides of the box. The compartments thus formed are not made of the full depth of the box, but are sufficient to inclose the bodies of the bottles, this being all that is necessary to give the required protection. This crate rests upon hay, straw, or other soft and yielding material covered by a piece of pasteboard for the bottoms of the bottles to cushion upon. The crate is kept down to its place upon the cushions by cleats nailed on the ends of the box, so that there is no tendency of the material used for the cushion to settle at either end while the box is being transported from the box factory to the place of use. These packing boxes have given the greatest satisfaction during their use of over a year by some of the principal bottlers of St. Louis.



SCHOENTHALER'S PACKING BOX FOR BOTTLES.

Additional information may be obtained from the inventor and manufacturer, Mr. J. C. Schoenthaler, of 1024 N. Main Street, St. Louis, Mo.

Renewal of Brain Cells.

According to the novel computation of a German histologist, who has been calculating the aggregate cell forces of the human brain, the cerebral mass is composed of at least 300,000,000 of nerve cells, each an independent body, organism, and microscopic brain, so far as concerns its vital relations, but subordinated to a higher purpose in relation to the function of the organ; each living a separate life individually, though socially subject to a higher law of function. The life term of a nerve cell he estimates to be about sixty days; so that 5,000,000 die every day, about 200,000 every hour, and nearly 3,500 every minute, to be succeeded by an equal number of their progeny; while once in every sixty days a man has a totally new brain.

The Cost of Making Steel Rails.

A recent issue of the Pittsburg *Penny Press* contains an interesting article on the cost of steel rails. The actual cost of producing a ton of steel rails in Pittsburg is placed at $26.83, as shown by the following itemized statement:

COST OF PIG METAL.

1·1 tons of coke, at $2	$2.20
Limestone	.50
Ore, scale, etc	10.00
Labor, including repairs	1.75
General expenses	.38
Interest	.35
Cost of a ton of metal	$15.18

COST OF INGOTS.

1 1-5 tons of metal direct at $15.18	$18.12
Refractories	.20
Lubricants	.02
Repairs	.24
General repairs	.17
Labor	1.13
General expenses	.09
Spiegel	2.31
Interest	.20
Cost of a ton of ingots	$22.48

COST OF RAILS.

1 05 tons ingots direct with initial heat at $22.48 per ton	$23.62
Labor and office expenses	1.90
Repairs entire	.49
Steam (natural gas)	.10
General expenses	.35
Interest	.22
Tools, files, etc	.15
Cost of a gross ton of steel rails	$26.83

The *Press* also states that the cost of making a ton of steel rails in England at present is $20.17.

Sulphite of Soda Intensifier.

Scolik, of Vienna, has recently experimented extensively with the above intensifier, and in a late number of the *Photographische Correspondenz* recommends the following formula:

Solution No. 1.

Bichloride mercury	1 oz. 437 grs.
Bromide potassium	1 oz. 437 grs.
Water	50 oz.

The above may be diluted four times its volume if desired, in order that the action may be gradual and less energetic. The fixed and well washed negative is allowed to remain in No.1 until the film becomes well whitened. If a small degree of intensification is desired, it should be left in but a short time.

The plate is next slightly rinsed off (a thorough washing not being required at this point), and immersed in

Solution No. 2.

Saturated solution sulphite soda	5 oz.
Water	5 oz.

The darkening action will be observed to take place gradually, as in the case when ammonia is used, and will impart a rich brown-black color to the negative, which should be well washed; negatives thus intensified are believed to be permanent. Dr. Eder describes the following as the chemical reaction which takes place. The whitened negative contains mercurous chloride (calomel), and this is reduced to the metallic state by the sodium sulphite, just as appears to be the case when cyanide of potassium is used; thus the method now described may be regarded as analogous with Monckhoven's argento-cyanide of potassium method. Mercuric chloride is not reduced in the cold by alkaline sulphites, because stable double salts are formed; still, at a boiling temperature, reduction sets in, the mercurous chloride being first formed, and then the metallic mercury.

The above fact explains why it is unnecessary to wash away all traces of mercuric chloride before treating with sulphite of sodium.

Fires from Belting.

Herr Boher, illumination inspector of Dresden, has been making some experiments to determine what part is played by electricity in causing explosions of flour dust in mills. His investigations have been conducted at the Royal Court Theater, where the powerful dynamos for the electric lights are driven by steam power.

"Here," the inspector says, "the electricity from the belting is so intense that more could scarcely be obtained in the best electric machines. Leyden jars became charged by this means in a few seconds, so that on being discharged sparks leap one and three-fifths inches. Any person standing on an insulator and placing the hand within four to six inches of the moving belts is quickly charged with electricity, so as to give out long sparks. Geissler tubes, having projecting pointed wire at one end, and metallic connection with the earth at the other end, glowed, when placed near the belts, with beautifully colored lights. In short, every experiment possible with electric machines can be performed by this belt developed electricity. At first I thought that the presence of the dynamo electric machines had a great influence on this phenomenon, but I have noticed the same, more or less shown, in many kinds of factories having steam power.

"In many flour and meal mills the dust has become ignited without the cause having been discovered. I have now, from experiments, become firmly convinced that electricity devoloped by belts can cause such disaster. In most factories, other than flour mills, the quantity of metal present, and the arrangement of the iron framed machines, is such that a connection among them is established sufficient to conduct safely away the electricity. It is, however, different in flour mills, especially where French burr stones are used, which are made of separate pieces bound together by thick iron bands. The latter are not connected with one another, but isolated by the non-conducting stone. Rims, therefore, which are next to the driving pulleys and belts (generally located just below stones when cogwheels are not used, and pulleys almost equal in diameter to the stones) become surcharged with positive electricity—as shown in the Leyden jar, for instance; the next nearest rim or rims will, by induction, develop negative electricity. These opposite forms of force having arrived at a dangerous degree of tension, the leaping of an intense spark from one stone band to another could ignite the excessively inflammable flour dust. To guard against this danger, it is simply needful to collect the iron spindles of the stones together by a thick wire, a metallic bar being at the same time located nearly touching both stone rim and driving pulley. In all other industrial works the precaution would be advisable that no isolated ironwork should be near pulleys and belting when combustible materials are also in the immediate neighborhood."

[The remedy above suggested, we fear, is of little avail. The connection of the spindles as proposed will not prevent the generation of electric sparks. A better prevention is to keep the atmosphere of the apartments where the belts run thoroughly damp.—ED. S. A.]

AT some of the theaters and opera houses in Europe water curtains are used as a safeguard against fire. Between the acts a wide, tenuous sheet of water descends, separating the stage from the auditorium. Its efficiency was recently proved at the opera house at Munich, Bavaria, when by its means a fire was checked instantly.

The Value of Our Export Trade.

It would be amusing, if the subject itself were not so serious, to see the way the partisan papers, or journals with one idea, handle the grave questions that concern our foreign and domestic trade. The first thing pressing on their attention is the low price of our agricultural products. These are now lower than at any previous date within the remembrance of the present generation. Wheat, which eight years ago sold at Chicago at something over two dollars a bushel, has recently sold as low as 75 cents. There was a time when it was said that Western farmers would let the ground lie fallow rather than grow wheat at less than one dollar a bushel; now the one dollar would seem to them a great price if they could get it.

To remedy this some have a theory ready made and duly patented. We only want, they think, a larger population. If foreigners will not buy our breadstuffs for the pinched and starving laborers now working for a pittance abroad (this is the way they put it), we ought to bring the weary sons of toil with their families to our shores. Once established here and set at work, they will furnish on their tables a ready market at a good price for all that our fields will yield.

But if they are agriculturists, they will only increase the glut by adding to the acres under cultivation. Our theorist has his answer to this all ready: It is the artisans he would bring, the men who work at trades, and whose only connection with the wheat product is to consume it. Here the trades-unions find their toes trodden on, and they cry out against the proposition. Wages, in their judgment, are already too low, and they will not have the number of skilled workmen increased by any foreign importation. And not only the higher class of mechanics, but the miners, the hod carriers, the 'longshoremen, and the ditchers are ready with pistol, club, and slungshot to resist every attempt to flood the country with rivals to share in the labor they would monopolize for themselves. Besides, if the immigrants, of whatever grade or character, did not after their arrival produce more in some way than they consume, they would but impoverish the country and increase the general embarrassment.

The protectionist has, as he thinks, a much more plausible remedy. The country is too much given to plain agriculture, and the business of wheat growing is overdone. Home manufactures are the true relief. Let Congress put a prohibitory tariff on the work of foreign mills, and let the spindle and loom be heard in every valley of the teeming West. If there is no water power let steam be substituted, and the farmer and the manufacturer exchange their products at each other's door.

But the manufacturing business is no better off than the agricultural. Stocks of fabrics have been piled in warehouse, awaiting a demand which would not come. The auctions have been crowded with goods which sold at far less than cost, and in the woolen trade alone looms have been silenced for a period that would have added twelve million yards to the stock already pressing for sale. The cotton mills are no better off, and the curtailment from idle spindles is now reckoned at over 100,000 packages of fabrics, amounting to nearly or quite one hundred million yards. If the West and South set up the factory for themselves, the busy industries of the East, many of which are even now temporarily embarrassed for want of custom, if they are to depend on the home trade as at present, must be altogether abandoned.

What, then, shall be done for the relief of the country? If the farmers and manufacturers alike are piling their surplus in the warehouses, and must either find a new market or check their production, who can suggest a fitting remedy? General Butler's answer is that there is no overproduction, but a want of ability to consume. If this is granted, and the consumption is ever so much stimulated after the Butlerian method, the problem will not be solved. There is no doubt but what some who now fare sparingly could eat a little more, and many who are wearing their old clothes would be glad of a new suit. To satisfy these fully would take off part of the present surplus, but would give no permanent relief. There is a limit even to the capacity of a hungry stomach; and those now poorly clad will be out of market for a while when they have all donned a new set of garments.

It is plain that we must find a demand for our produce and manufactures alike outside of the home trade. The vast fertile fields of the West and Northwest and Southwest will grow more grain than can be digested by American stomachs, and the surplus, growing larger with each succeeding year, must be sent to feed the hungry of other lands. In like manner the manufacturing industries of the country are becoming too large for the home market, and must find customers for their wares and fabrics on distant shores.

Whatever is done in the future in tariff legislation, therefore, if done wisely, will have a special reference to encouraging the export trade of the country. There are still extant some pamphlets from our pen issued over thirty years ago, and compiled largely from editorials in this paper, showing that free trade in raw materials, dye stuffs and the like, with a judicious tariff on manufactured goods, was then what was most needed to promote the welfare of this country, by building up a large and profitable trade with foreign nations. Numerous editions of those treatises were circulated through the interior, and served a very useful purpose in opening the eyes of the people to their true needs, and the simplest remedy for prevalent embarrassments. Isolation is not the road to prosperity; if we would thrive we must take the world into our embrace, and be ready to minister to its wants and to share our profits with others, if we would enhance the measure of our own gains. Service of some sort beyond the requirements of self is the one condition of all true success.—*N. Y. Jour. of Commerce.*

Lord Rayleigh's Experiments on Light.

Lord Rayleigh, the president of the British Association at Montreal, has in the past devoted much attention to the subject of light; his papers on the subject have appeared in the publications of various scientific bodies, and in the *Philosophical Magazine* and other scientific journals.

In some of his earlier experiments he worked at the reproduction of diffraction gratings by means of photography, the latter having such minute delineating power. At first he thought of drawing gratings on a large scale and then reducing them by means of photography, but abandoned the idea, chiefly because he thought it doubtful whether photographic or other lenses were capable of doing the work. He, therefore, began by taking a Nobert's grating with 3,000 lines to the inch, and printing an impression from it direct, upon a dry photographic plate, just as transparencies are taken for the magic lantern. In the printing he used almost parallel rays of solar light, so that if the two plates did not touch at particular places, a shadow image of the adjacent lines might nevertheless be thrown upon the sensitive surface. He thus produced copies comparing not unfavorably with the original. The plates had to be very flat; even patent plate was scarcely flat enough, the use of worked glass being the remedy.

The vehicle for the sensitive photographic salts employed by him was sometimes collodion, sometimes albumen, both of which give delicately thin films. With these vehicles almost any photographic dry process would answer the purpose, and after a little practice he could produce copies equal to the originals in defining power, so far as he could see. After partial development he cleared the more transparent parts with iodine, after which the deposit in the intensifying process fell entirely upon the parts intended to be opaque. With the copies the nickel line between the D lines is easily seen. He worked in a dark room, with a slit in its shutter, and the grating placed at a distance from the slit. No collimator was used. The telescope consisted of a single lens of about 30 inch focus, with an ordinary eyepiece held independently. He prefers this to placing the whole arrangement upon one stand, as in the ordinary spectroscope.

He also experimented on the reproduction of gratings by means of bichromated gelatine, omitting the coloring matters usually added thereto in the carbon process. He poured on the bichromated gelatine as he would collodion, and allowed the film to dry in the dark. The printing was done by a few minutes' exposure to direct sunlight, and the development by treatment with warm water, which dissolved off the gelatine where not acted upon by light. The gratings thus produced were transparent in every part alike, yet they give brilliant spectra; the effect, therefore, must have been produced by the alternate linear elevations and depressions of the surface. By pressing soft sealing wax on these transparent gratings, the wax assumed the appearance of mother-of-pearl. He does not think that in the development any of the gelatine was dissolved away, but this conclusion, when viewed by the experience of those versed in the carbon process, is doubtful. The gelatine may have been rendered insoluble throughout its front surface, yet some of its organic constituents may have found their way through the exterior skin. There was uncertainty in the production of these gelatine gratings, but one or two of much perfection were made, giving spectra surpassing the original in brightness. The reason, he says, is that "on account of the broadening of the shadow of the scratch, a more favorable ratio is established between the breadths of the alternate parts." From the appearance of these earlier photographed gratings under the microscope, he concluded that 6,000 lines to the inch could be printed by the method, by which, also, the cost of diffraction gratings was likely to be considerably reduced.

In later experiments he discovered that he could photograph a piece of striped stuff, to produce an image on such a scale that there was room for about 200 lines in front of the pupil of the eye, capable of showing lateral images of a candle. The reduction was effected in a camera. He soon found that optical appliances are inadequate to the production of very fine gratings, from inherent imperfections in lenses, as well as from impediments due to the laws of light. Nevertheless, he thinks that by means of special appliances it might be possible to get 3,000 lines to the inch by this method, although the prospect is not particularly promising.

Direct printing from cut gratings he, therefore, considers to be the best method. He takes care that during the printing the glass front of the printing frame is at approximately a right angle to the incident light of the sun. Usually he cuts off most of the side light by partially closing the shutters of the room, but he cannot say whether this is necessary. With the more sensitive processes artificial light may be employed. Lord Rayleigh made some copies of gratings by the aid of a moderator lamp with its globe removed; the printing was done at a distance of two feet. All the glass surfaces have to be very clean, the pressure in the printing frame is moderate and even, and when the photographic film is delicate, care must be taken not to scratch it by a sliding rubbing motion. He is careful not to injure the engraved face of a grating, so scarcely ever touches it with wash leather or any other solid. He prefers to wash it, when soiled, with a stream of water from a tap, afterward flooding it with pure alcohol, and then setting it up to dry spontaneously. After taking several hundreds of copies of his gratings, the originals have scarcely, if at all, deteriorated. He finds that out of a package of two dozen 5 by 4 sheets of patent plate, as sold by the dealers, three or four may usually be selected flat enough for the photographing of gratings. Plates of the size mentioned may be cut with a diamond, and will do very well for four gratings, but it saves work and trouble not to cut them until they have been coated with the photographic film.

Lord Rayleigh, after trying many processes, some of which he abandoned, he says, for reasons which might not have necessitated their abandonment in the hands of a skilled photographer, felt most inclined to recommend Mr. G. Wharton Simpson's collodio-chloride process for preparing the plates. The details of this process may be found in photographic works, but it consists essentially in first coating the plate with dilute albumen, and drying it, then coating it in the developing room with an emulsion of chloride of silver in collodion; the emulsion contains a slight excess of free nitrate of silver. The exposure for printing is about five or seven minutes to the autumn sun; no development is necessary. The plates are washed in water, and then, without any toning, fixed with thiosulphate of soda. He increases the brilliancy of the spectra by finally washing these photographed gratings with corrosive sublimate, which, however, probably destroys their permanency. The use of very finely divided diffraction gratings is, Lord Rayleigh points out, not necessarily an advantage in the investigation of the solar spectrum, although it conduces to brilliancy. He has two by Nobert, one containing 3,000 and the other 6,000 lines to the square inch. The spectra of the 3,000 line grating were much the best in respect of definition, and the same was the case with the photograpic copies. The extra brilliancy of spectra with more lines is of no use if a higher magnifying power is necessary than the spectra will bear.

In testing gratings, Lord Rayleigh prefers to work in a dark room with a slit in the shutter, through which a direct beam of sunlight is steadily sent by means of a heliostat. He makes the slits cheaply, instead of using the ordinary appliances, but, at the same time loses the power of regulating the width by a screw motion. His plan is to coat a sheet of glass with tinfoil; weak shellac varnish is used to make the tinfoil adhere; the alcohol is allowed to evaporate, and after application of the tinfoil, the shellac film is softened by heat. Had paste been used, time would have been necessary to permit the drying of the aqueous film between the impermeable glass and tinfoil. To make a slit, it is next only necessary to cut a straight line in the foil with a sharp knife, and to wipe the line of the cut with a rag moistened with alcohol. Broader slits are made by removing the foil between two parallel cuts.

Despite his care in selecting samples of patent plate, it is evident from his records that, altogether, there is much more safety in using samples of worked glass for delicate photographic productions of this kind. With worked glass copies from the 3,000 line grating, he can usually make out nearly, but not quite, all that is shown in Angstrom's map. Among the photographic gratings on picked patent plate there are usually some whose performance is less satisfactory, though most of them, under low powers, will bear fair tests. He is uncertain as to the limits attainable of photographing fine lines in this way, but thinks it possible that with a flexible support to the film, such as mica instead of glass, ten or twelve thousand lines to the inch might be copied. Gratings may also be made on Brewster's principle, by taking a cast. Lord Rayleigh has obtained fair results by allowing filtered gelatine to dry, after being poured on the 3,000 line Nobert grating. This method is attended with risk to the original, and has other objections.

A Revolving Hearth Gas Generator.

A somewhat remarkable form of gas generator furnace, intended, in the first place, for the large productions of gas required in iron and steel works, has been designed by M. Pierrugues, and is illustrated in a recent issue of the *Revue Industrielle*. The generator is circular in plan; the bottom courses of the sides being set in a cast iron curb, supported on short piers or columns above the floor line. The bottom or hearth of the generator is built quite separate from the sides. It is a mushroom-shaped structure of grids slightly inclined from the center, which is pivoted upon a pillar, on which it turns freely. The circumference of the hearth is fitted underneath with a rack, similar to that of a mortar mill; and consequently the whole hearth can be revolved by a hand pinion working in this rack. The idea will be sufficiently evident from the following description: The generator is charged in the usual way, through hoppers at the top; the gas outlet being likewise at the top. At any convenient part of the structure, a fixed bar from the side projects a regulated distance over the outer edge of the circular grill; and underneath this point is the truck for removing the ashes and clinker. The clinkering is done by revolving the hearth, by hand or power; so that the fixed bar sweeps off the material into the truck beneath. It is contended that this arrangement facilitates the regular working of the generator, and thereby enables the poorest and dustiest kinds of fuel to be properly gasified. It is evident that with a generator of any considerable size this convenience must be purchased by a large expenditure of power in rotating the grill with its load of fuel in active combustion.

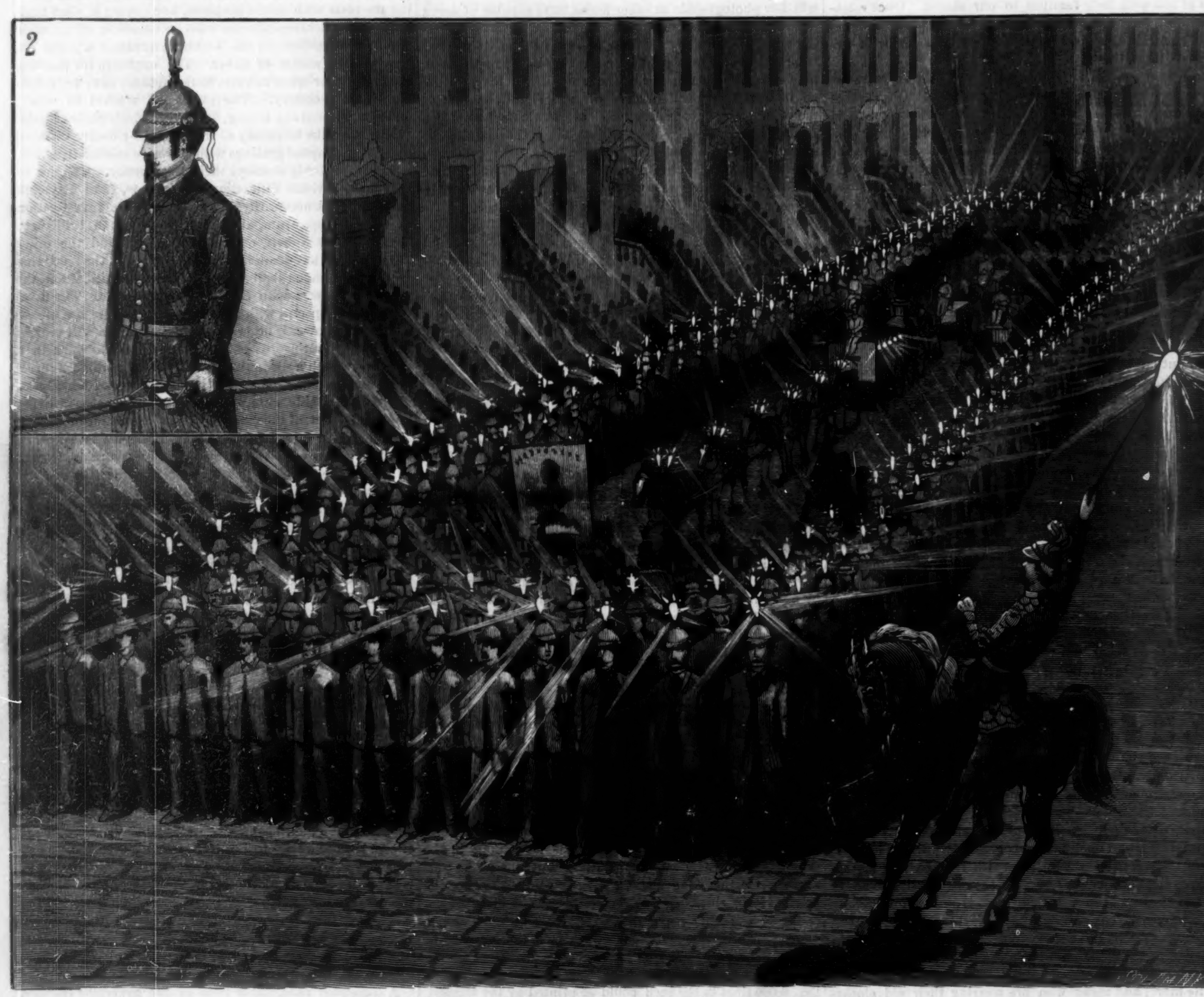
AN ELECTRIC TORCHLIGHT PROCESSION.

On the evening of October 31, this city was favored with one of the most unique and attractive displays ever seen in a torchlight procession—that necessary adjunct to a presidential campaign, which brings into active play the inventive genius of party managers and enthusiastic followers. That an electric lighting plant, complete in every detail, and in full operation, can be moved at the uneven pace of a procession over the rough paving of a street, without interrupting the current or in any degree changing the brilliancy and steadiness of the light, is a fact which, while of interest to the scientific world, clearly shows the perfection to which electric lighting machinery has been brought.

The work of preparing the display was done by the Edison Electric Lighting Company, the expense being defrayed by its own employes, who united with insurance men of the same political faith. Placed upon the forward part of a large truck was a dynamo—a 200 ampere machine—behind which was a 40 horse power engine of the New York Safety Steam Power Company; a belt led from the engine to a pulley on the armature shaft. Secured to the truck was the pole of one of the largest steam fire engines built by the Clapp and Jones Company. The electricians in charge of the display felt assured of the successful working of their dynamo and engine, and in order to have an ample supply of steam, they obtained the fire engine, which they knew to be a rapid and reliable generator while in motion. Extending from this boiler to the engine were two flexible pipes, one leading to the steam chest and the other carrying the exhaust. The latter pipe was provided with a three-way valve, by means of which the steam could be directed either into the smokestack to increase the draught, or into the open air. Following the fire engine were two ordinary watering tanks, holding 950 gallons, which were connected to the feed pump by lines of hose. Between the tanks were the coal carts. The dynamo truck was drawn by six of the Herring Safe Company's mammoth horses, arranged tandem and guided solely by the word of the driver.

Extending from a switch board on the floor of the truck were four covered copper wires, two of which led to a rope upon one side of the truck and the other two to a rope upon the other side. This rope was 1,200 feet long, and was extended up and down the procession so as to form a hollow square, in the center of which was the machinery, before and behind which marched bodies of men. Placed at each five feet on the rope was an ordinary cut-out, or lamp receptacle, slightly changed to suit the requirements of this work, and within which screwed a safety catch carrying two wires, which led up the sleeve and through the back of the helmet to an incandescent lamp of 16 candle power. Wires also led to lamps hung upon the hames of each of the horses, and to 24 lamps arranged on a frame built around the truck. The leader of the procession, on horseback, carried a staff surmounted by a 200 candle power light. Altogether there were some 300 lamps distributed along the rope and upon the trucks.

Upon the first and last part of the line of march every part of the plant worked most admirably, and the illumination was intense and beautiful, the light flooding every nook and cranny in the streets passed through. But in the intervening distance, which chanced to be lined with people who were particularly anxious to witness the electric light display, this portion of the parade was conspicuous solely on account of the darkness that pervaded it. This interruption was caused by mud from the water tanks clogging the hose leading to the pump. All went well after the hose had been cleaned.



THE ELECTRIC TORCHLIGHT PROCESSION IN NEW YORK.

Fall Plowing.

Joseph Harris thinks that farm horses can be put to no better use in autumn than pulling the plow. In the September *Agriculturist* he says: "There is nothing pays so well as fall plowing, and getting land ready for spring sowing. The longer I live the more I am impressed with this fact. I say nothing on the disputed question in regard to breaking up sod land in the autumn. It is possible, as some claim, that there is a loss from drainage. But if any one will plow my land in the fall, I will run the risk. But what I have specially in mind is, land not occupied with any crop—corn land, potato land, bean land, stubble land, and weed land. Stick in the plow if you can spare the time; if not, harrow or cultivate. Better still, do both. Light sandy land, plowed and prepared in the autumn, can be sown in the spring without plowing. Heavy land, if plowed and worked in the fall, may need plowing again in the spring, but the work will be easier and the land better. Keep the horses busy until snow flies. But the earlier the work is done, the better. One plowing while the land is dry is worth two plowings when it is wet.

Ventilating Hay Mows.

After adding his testimony to the correctness of our theory as to the cause of frequent fires in barns, an architect from Iowa writes to the *American Architect*, into which paper our article was copied, the following letter: We believe the idea of the writer is not new, and that patents have been granted for similar models of ventilating hay mows and grain bins, nevertheless the suggestions of the writer are good.

"As this matter is of more vital importance than most people, even scientific men, are aware of, I will," says the *Architect's* correspondent, "venture to suggest a mode to ventilate hay lofts, and to give veterinary surgeons something to think of. I believe that one-half of the diseases in horses and cattle is brought on by feeding spoiled hay, either taken from hay mows or stacks, also from grain feed that has been heated and spoiled. I believe that the heating process, the mouldy parts and must that it produces, will create germs of various kinds that cause diseases in horses and cattle and perhaps swine. I will now venture to suggest a mode of ventilating hay mows, stacks, or granaries. I will suggest introducing various air ducts through the hay mows, both horizontal and perpendicular, opening directly outside, so as to admit a current of fresh air, which will cool and cure the hay or grain, and leave it in a healthy state. This may be done by building board ducts and perforating them as much as possible, and then running from the horizontal ducts perpendicular ducts up through the mow, not more than eight feet to ten feet from each other. Or this may be accomplished in another manner, by using some round instrument, six inches to ten inches or even larger in diameter, say a galvanized iron tube; stand it over the openings in the main air duct, and as the mow is filled up, draw these pipes up through the hay, until the top is reached. This will afford complete ventilation, which will be increased as the mow becomes heated; hence the fresh air drawn in will cool and cure the hay or grain, and by this process thousands of tons of hay and grain can be saved and a vast amount of property will be saved from the destroying elements."

Manufacture of Wood Pulp.

The author treats the comminuted wood or other vegetable matter with concentrated solution of sulphurous acid and water under a pressure of 5 atmospheres and at temperatures ranging from 75° to 80°.—*Raoul Pictet.*

Restoring Burnt Steel.

At the Nuremberg technical school a series of attempts have been made to restore the original qualities of steel after it has been burnt in the forge. These tests have been carried out with various classes of steel in common use for tools, and with varying degrees of success. Sometimes this accidental burning can be repaired by hammering the piece of steel while hot; but more generally it is only worth returning to the scrap heap. The alteration known as burning is due to a more or less considerable decarburation of the metal. Among the processes that have been devised for restoring burnt steel, the following has given excellent results: The piece of metal is brought to a red heat and suddenly plunged in a mixture composed as follows: Pitch, 2 parts; train oil, 2 parts; tallow, 1 part; with a small addition of common salt. This operation is repeated two or three times.

A Question of Steamship Models.

The speed of the steamer Finance, of the United States and Brazil Steamship Company, which made the trip from St. Thomas to this city in five days, is owing—according to the statement of one of her officers to a *Tribune* reporter—to her model.

"She is nearly flat on the bottom, and has no keel except her two bilge keels, or rolling keels as we call them. This gives her great carrying capacity as well as speed. Her bows have a fine entrance, but the body of the ship is carried well forward under the water-line, so that when she goes into a sea she rises like a duck and does not stagger. I think that American-built ships have a greater carrying capacity and develop more speed with less coal than any others in the world. The swift steamship America is a much larger vessel than the Finance, yet the America only carries about 2,000 tons of cargo to the Finance's 3,166 tons. The America is, of course, the faster ship, but not enough faster to make up for the difference in carrying capacity. The Finance can make 14 knots an hour, and the America 18. The Finance burns from 28 to 30 tons of coal a day, and the America 175.

"There is the ship San Pablo, a typical American ship. She has developed a speed of 16 knots an hour with a consumption of 32 tons of coal. She carries a dead weight of cargo of 4,500 tons. She recently made the fastest passage on record between here (New York) and Gibraltar. She is now running between New Tacoma, on Puget Sound, and San Francisco. The round trip takes 10 days. In 30 days she made three round trips and started on her fourth, and has landed 12,500 tons of coal. In nine months she has cost only $26 for repairs in the engine-room. She is built something on the model of the Finance, but has a keel. The City of Rome burns 320 tons of coal a day and can only carry 1,000 tons of cargo. The great freight ship of the National Line is the England, which carries 3,500 tons of cargo. She makes about 12 knots an hour, and can be pushed to 13.

The England is 437 9 feet long, 42¼ feet beam, and 35 feet depth of hold. The Finance is 300 feet long, 38·4 feet beam, and 23·6 depth of hold. The Finance is not, of course, a fast ship, compared with the greyhounds of the sea, but, as you see, attains a respectable speed, has great carrying capacity, and besides that is a passenger ship. And look at the San Pablo with a speed of 16 knots, a carrying capacity of 4,500 tons, and consumption of only 32 tons of coal. It is all in the model. I believe that a ship as large as the Oregon or America and with much less engine power, built on the flat bottom model, would beat their time badly, and have twice or three times their carrying capacity."

Cocaine Hydrochlorate.

The honor of discovery of this new local anæsthetic is due to Dr. Kollar, a young medical student, still engaged in his studies at Vienna. Hydrochlorate of cocaine has been used in this city with success in many cases, especially in ophthalmic surgery. A few drops applied to an injured eye allays the pain, produces immediate insensibility of the parts, and enables the surgeon to operate with success. This discovery forms an important step in the progress of medical knowledge. The hydrochlorate has been used in the opening of felons, for sensitive throat, etc.

THE Pacific coast has nearly doubled its crop of hops this year over that of last, without materially increasing its consumption.

TWO NEW OPTICAL ILLUSIONS.

All optical illusions which have for result the exhibition of an isolated portion of a live human body, such as a head separated from the trunk, a bust without a body, or a body without a head, always surprise and interest the spectator.

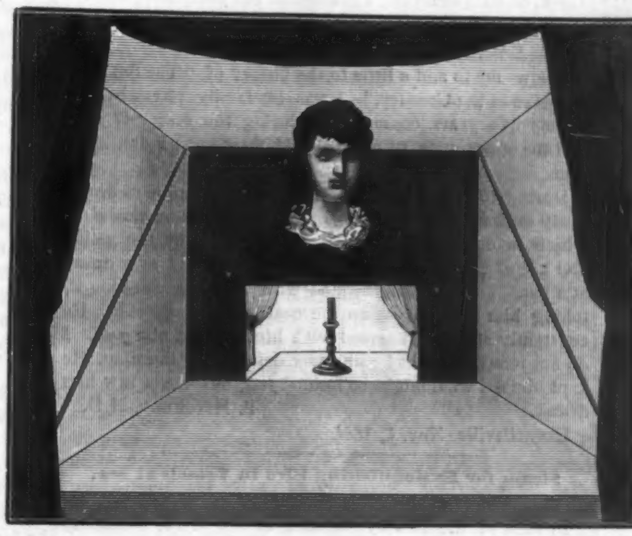


Fig. 1.—AN ISOLATED HEAD IN THE CENTER OF A STAGE.

We learned in early childhood that life is impossible under such circumstances, and yet, if the experiment be well presented, we distinctly see the reality of what our judgment and experience are in accord in declaring impossible. We are tempted then to doubt the evidence of our eyes, notwithstanding our daily confidence in those organs.

This sort of contest between the senses and reason lasts a longer or a shorter time, according to the spectator. It is quick in some, and slower in others; but it may be said that in almost all, this kind of spectacle strongly excites the curiosity. For this reason, ever since the first exhibition of the decapitated talker by Colonel Stodare at London, prestidigitators and physicists have been exerting their ingenuity in order to obtain analogous effects by varied processes; and so there has appeared a large number of decapitated talkers, living busts, half-women, persons with two or three heads, men cut in pieces, and decapitated bodies of all sorts. As an example of the apparent realization of several of these physiological impossibilities, we may cite a singular exhibition that is now being held at London, in Egyptian Hall. A physician and his patient are upon the stage, and engage in a very animated conversation; the sick man seats himself in an arm chair, and the physician cuts off his head and lays it upon a table. The head speaks, and threatens the physician with the vengeance of heaven, and then the headless body rises, and, by expressive mimicry, joins its reproaches to that of the head. Then it takes the latter upon its arm, and the dialogue goes on—the head always talking, and the body gesticulating.

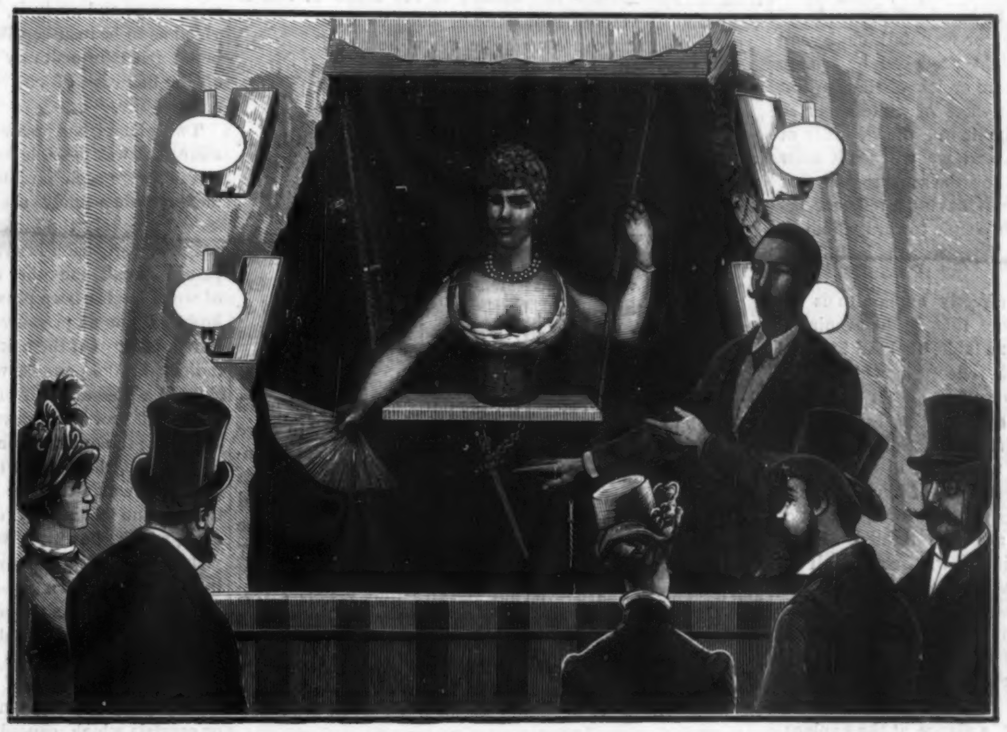


Fig 2.—THE WOMAN WITHOUT A BODY.

Fig. 3.—EXPLANATION OF THE PHENOMENON.

After seeing this sort of spectacle a certain number of persons go away indifferent to the processes by means of which such effects are obtained, while others, on the contrary, are interested therein. It is for the latter that we shall describe in this article two new tricks, that have recently been shown in Paris, at the theater Folies Bergeres, under the names of *Stella*, and *The Mystery of Dr. Lynn.*

Stella.—The spectator, upon entering, sees in front of him a large panel in which there is an aperture about 5 feet square closed by a silk curtain. When the latter is drawn aside, there is seen a small and elegantly decorated stage, whose sides may be perfectly distinguished. In the center of this stage, suspended in space, there is a young girl's head, the neck of which starts from a satin collar (Fig. 1). This head is well isolated on every side; one sees the rear of the stage, the sides, the top, and the bottom, and the light leaves no portion in shadow. The head is living; it speaks and smiles, the eyes move, and the exhibitor further proves it by presenting to it a lighted candle, which it extinguishes by blowing it out. The exhibitor then disappears behind the side scenes along with the candle. He now, as it seems, draws out a panel in the back of the stage, and through the aperture thus formed, the spectator very distinctly sees the top of a table, and, upon it, the candle that the head has just extinguished. Now this aperture is directly under the head, but much farther off, and is in the direction that the body would occupy if the head possessed one. The absence of the body is therefore well demonstrated, and the curtain drops.

Such was the evidence of the eyes, but the reality was entirely different. The head was indeed real, and was seen directly, and the same was the case with the top and a part of the sides of the stage, but aside from this the rest was only an illusion. The stage had no back, no floor, no sides, and the aperture seen in the rear was not in that place.

The illusion was obtained by means of a simple mirror, which, starting from the upper part of the back of the stage, descended obliquely to the front. In the center of this there was an opening which was concealed by the satin collar of which we have just spoken, and through this the young girl passed her head. The inclination of the mirror was very easy to determine; it was in fact indicated by a gold rod designed to hide the line of junction of the mirror and side. Through their reflection in this mirror the anterior part of the top seemed to be the bottom, and the posterior part of the same produced the back of the stage. The sides, of which only the upper portion was seen, seemed to be prolonged and join the bottom. As for the aperture through which the table was seen, that was in reality at the top; the table was vertical, and the candle, which was firmly fixed to it, was horizontal. The farce of blowing out the candle and carrying it behind the scenes was only designed to make the spectators believe that it was the same candle that was seen at the rear of the stage, while it was only a duplicate.

The arrangement of the top and sides with respect to the mirror may be perfectly ascertained by means of a very simple experiment. Take a small, square mirror and incline it at an angle of about 35° or 40°, while it rests upon a book; then place above it a piece of cardboard, or anything else, and it will be found by experiment what inclination should be given it in order to obtain, through reflection, the semblance of a vertical back.

Upon bringing the same cardboard near to the sides of the mirror, the part that will be above the latter will seem to be prolonged beneath. If one wishes to take the trouble to fix several pieces of cardboard in these different positions with pins, he may produce the semblance of a space which is apparently completely empty, while it is cut into two by an inclined mirror. It would be easy thereby to get an idea

of the process used for producing the illusion given by *Stella.*

The Mystery of Dr. Lynn.—In this new illusion, now being presented at the Folies Bergeres, the stage is larger than for Stella. It starts from the floor; and it is nearly in front, at a very slight distance from the spectator, that we observe the bust of a woman cut off at the thighs and resting upon a small swing shelf. This woman is alive. Moreover, under a thrust from the showman the shelf moves laterally. At a certain moment the woman seizes the cords, the exhibitor removes the shelf, and the body is then seen suspended for a few minutes. The showman passes a rod beneath the bust, and around it, and shows that it is completely isolated.

Where is the body? Such is the question that every visitor asks. In Stella and in several analogous tricks shown by English and French prestidigitators, completely isolated, but immovable, busts or heads were shown to the public, and the majority of these illusions was obtained by means of mirrors. Even with these latter it would be possible to move a bust and swing a shelf, but we believe that *The Mystery of Dr. Lynn* is obtained by a much simpler process—by a simple effect of illumination.

All painters know that in a too strongly lighted picture the whites and bright colors stand out at the expense of the half tones and dark colors, and this effect is the more pernicious in proportion as the light is brighter. Hence the complaints that are heard at exhibitions of paintings, where the light never suits the exhibitor. This same effect is seen in two objects placed alongside of each other; if a white object be placed alongside of one of somber color, it will prevent the details of the latter being distinguished as well as if it were alone. The visibility of objects is relative, then, and depends more or less upon the brilliancy of that which surrounds them. A thing that attracts the eye is seen at the expense of what is placed alongside of it.

This difference in visibility, which makes itself seen when the illumination of two objects is the same, will naturally be still greater if the white object is in the full light and the somber one in darkness. Now it is upon this principle that the Doctor Lynn trick appears to be based.

If we take a book bound in black or very dark cloth, and place it outside of the cone of light produced by a lamp shade, we shall be able to see it more or less distinctly; but if in the same direction we place a sheet of white paper so that it shall be well lighted by the lamp, the visibility of the book will be null or nearly so, and we will see it anew if we take away the paper. It is for the same reason that a person who at night holds a lamp having a reflector becomes completely invisible to other people toward whom he turns the light, while he might be seen were the lamp turned in another direction.

Another small experiment will directly explain to us the Doctor Lynn trick. Let us suppose that in the evening a person dressed in black leans upon a table, his head inclined between two lamps provided with reflectors, which latter may be merely white cardboard, or a few sheets of paper; or the lamps may be replaced by two candles, each shaded by an open book. Under such circumstances the spectator seated upon the other side of the table will distinctly perceive the face of the person placed in front of him, the white parts of the costume, the neck, sleeves, and fore portions of the shoulders and arms, which are well lighted. But if there is no reflection from the ceiling or wainscoting, all the rest of the body placed in darkness will be invisible.

Let us suppose that all the precautions are taken to make the experiment successful, just as if it concerned a public exhibition, and we shall be able to have in this way a decapitated talker, a living bust, or to repeat the mystery of Doctor Lynn.

As regards this last named trick, a glance at the explanatory figure (Fig. 3) will show how the illusion may be obtained. The lower part of the bust seen is a dummy, upon which the upper part of the woman's body rests, the remainder of her body being extended nearly horizontally upon an apparatus that is capable of swinging and following the motion of the shelf. All this portion is hidden by opaque black drapery so arranged as not to attract the light to any point.

The bust and shelf receive a very intense light; then immediately behind there is seen intense darkness—an absolutely black background. This latter is rendered still darker by the brilliant cords of the shelf, a metallic chain, a sword suspended beneath it, and a white handkerchief that seems to have been dropped upon the front of the stage by accident. If we add to this, six gas burners with powerful reflectors turned toward the spectators, it will be seen that the latter are, in a manner, dazzled by everything that strikes their eye in the foreground, and that beyond this they see absolutely nothing but a black background.

Such is the explanation that may be given of the mystery of Dr. Lynn—an illusion that rests upon a curious principle in physics.—*G. Kerlus, in La Nature.*

Trade Marks in Japan.

By imperial decree dated June 7, 1884, a trade mark law has been promulgated in Japan, the law going into force on the first of October. Persons who counterfeit registered trade marks and employ them will be punished by imprisonment with hard labor for a term of not less than thirty days and not more than one year, in addition to a fine. A trade mark in Japan runs for 15 years. Nearly all classes of goods manufactured are included under this new act.

Correspondence.

The Smartest Old Man in the Country.

Under this heading we chronicled in our paper of Nov. 1, an account of the walk of seventeen miles by Seth Cook, of Rathboneville, a gentleman 103 years old. The following curious particulars will be read with interest:

To the Editor of the Scientific American:

Allow me to add a little to the history of "The Smartest Old Man in the Country." I was his family physician for twenty-five years, commencing during the year 1847. He had the appearance of quite an old man when I first knew him.

During that time he lived in constant violation of nearly every sanitary law. His constant drink was *pure alcohol,* of which he drank large quantities, buying it by the gallon and keeping it in the house. I think he rarely ever drank at a bar. I often remonstrated with him for drinking it, telling him it would eat up the coats of his stomach. He constantly affirmed it agreed with him and did him *good.* I do not remember that he was ever sick during the time. He kept himself what might be termed *full,* but never saw him drunk. S. MITCHELL, M.D.

Hornellsville, Nov. 1, 1884.

Steam for Extinguishing Fire in Vessels at Sea.

To the Editor of the Scientific American:

In view of the loss by burning at sea of the steamship Maasdam, on the 24th of October last, I suggest the use of steam as an incomparably more effective agent than water in the extinguishment of fire in vessels at sea, or in any confined situation of limited extent. In all vessels driven by steam power, let it be considered a primary necessity that conducting pipes for steam be laid, and so connected with the boilers for generating steam for power, as to make it possible to deliver it at any and every part of the vessel liable to take fire from accidental circumstances, as in the case above referred to; from lightning, not a very infrequent cause; or from the spontaneous combustion of the cargo in remote and practically inaccessible parts of laden vessels.

From the latter cause we quite often hear of the occurrence of fire in the holds of vessels, and particularly those laden with cotton, in which fire has been known, with closed hatches, to smoulder for days and even for weeks before the final catastrophe of its breaking out was reached. In such cases, no amount of water that could be supplied short of sinking the vessel would, with certainty, accomplish the object, because it would inevitably descend to the floor of the vessel and away from the fire. With steam as the active agent, this would be entirely different. The moment it was ascertained in what compartment, or place in a vessel, fire was located, steam could, by the opening of a valve at or near the boilers, be instantly delivered there, through the open ends of pipes, and would with almost absolute certainty reach and extinguish it.

That the supply of steam for the purpose be assured in all stages and localities of a fire, it would be necessary to have main valves for controlling its distribution situated at a convenient place on deck; also, to have one or more small extra boilers, like those for driving steam fire engines, located there, *as reserves,* to be used in connection with the same system of conducting pipes as those above named. It may be added, also, that boilers of this kind could be supplied and used for this purpose on any and all sailing vessels, carrying large and valuable cargoes, thus practically insuring that class of vessels also against destruction by fire. Of course, the use of steam boilers for such purpose would necessitate the employment and presence of one or more men among the officers or crews of sailing vessels qualified to use them.

In such cases the arrangements for distributing steam to every part of a sailing vessel would be the same as in the other.

The advantages in the use of steam for extinguishing fire are that by aid of its pressure in the boilers it can be forced into and through every compartment or subdivision of a vessel, and by many branch pipes, near the extremities, with open ends, into every *crevice,* even, of the cargo. Thus, by its dampening effect on all surfaces with which it would come in contact, the tendency to ignite and burn will be greatly lessened, while its extinguishing power results from the exclusion, by its pressure, of a large part of the air necessary to support it, and by the reduction in the temperature in what remains below the point of combustion, thus ending the danger.

If by the use of arrangements for the purpose, so simple, inexpensive, and efficient, the owners of vessels can secure their comparative safety against fire, why should not passengers, officers, and crews have protection against danger from one of the most remorseless of all destructive agencies known to man? H. A. BUTTOLPH.

Morris Plains, N. J., Nov. 4, 1884.

Sulphuret of Carbon as a Disinfectant.

M. Peligot has presented a "Note" to the *Comptes Rendus* on some newly discovered properties of sulphuret of carbon. Contrary to the teaching of the text-books, sulphuret of carbon is soluble in water, in the proportion of 2 to 3 milligrammes per liter. The compound stops fermentation, and kills microbes. The manipulation of the liquid is perfectly harmless, and it is erroneous to say that work people, employed in factories where it is used, are poisoned in consequence. No such ill effects as are supposed to emanate from this cause have been detected by M. Peligot in workmen continually living in the midst of sulpho-carbonaceous vapors. The respiration of the vapor of sulphuret of carbon occasions, after a few minutes, a state of anæsthesia similar to etherization, which speedily disappears. The aqueous solution has a sweet taste, and produces a sensation of heat in the mouth and stomach. The author thinks that this solution will be useful as a perfect and harmless antiseptic. In cases where the spread of an epidemic through contamination of the water supply is to be feared, he proposes that the supply should be passed through apparatus whereby it may be impregnated with sulphuret of carbon.

Timber and Tools.

It is a fact well known to millmen that it is not always the harder woods, in the ordinary acceptation of the term, that are the most wearing to the saws. Many practical persons marvel at this, and wonder to themselves why a piece of timber showing small crushing, tension, and other strengths, requires more power to work into lumber, and at the same time wears out the saws and cutting tools faster, than other varieties of timber, the strength of which, in most respects, is greater.

According to the *Lumber Trade Journal,* a log of black walnut and one of burr oak of the same size worked into the same sized stuff will show widely different results on both saws and machinery. If we attempt to rive or split these logs, the walnut will work much easier than the oak, and so far as the various strengths are concerned the oak is superior by far, but when worked or cut into tools of any description the walnut presents much greater resistance than the oak, and the same is true as regards many other varieties of hard and soft timber.

If we take a longitudinal section of these comparatively soft timbers which are so hard on cutting edges, we will find the minute pores or interstices filled with minute glistening particles or crystals; and subjected to chemical analysis we will find them composed of silica, one of the very hardest minerals known, while with the hard, easy working woods they will be found nearly or quite absent by both the microscope and analysis. These little particles, so finely divided as to be insusceptible of ordinary touch, are really a better grit than ordinary sand, and are the means of cutting off the fine edge of cutting tools, as saw teeth, plane irons, and the like.

Two plane irons, made of a fine quality of steel, as near alike as it was possible to make by an accurate, skilled mechanic, were each hardened in our laboratory by means of mercury, then finely sharpened, that the edges of each presented precisely the same appearance beneath the magnifier.

These were each inserted in an ordinary plane, and one placed on oak, the other on a piece of walnut, both pieces of wood having been previously dressed. At the rate of one hundred pounds pressure, each iron was crowded forward four inches. On the oak stick, the pressure from the rear indicated 809·5 pounds, while with the walnut the indicator showed a pressure of over one thousand pounds. The irons were both now withdrawn, and first placed beneath the microscope; the one used on the oak presented a general upset appearance, the edge of the iron showing a slight tendency to turn downward, there being sufficient heat generated by the friction to partially draw the temper along the minute edge, which, however, would not extend back sufficient to materially affect the wearing and cutting properties of the iron if in constant use.

The iron used on the piece of walnut showed a scratched, notched appearance all along the minute edge, and by the aid of the most accurate means of measurement at hand, these notches were all of the same depth, but different distances apart, proving conclusively that the particles of grit or crystals which caused them, by being harder than the best mercury hardened steel, were all of the same size, and evenly distributed, as far as regards depth of deposit in the grain of the wood. The small spaces of the iron edge between these notches or scratches were found nearly as the entire edge appeared originally, showing again that the cellular tissue of walnut, outside its mineral deposits, was really softer than that of oak; hence, were it not for these deposits, the timber would cut much easier. Of course, if the iron had been been drawn back, and again shoved through, the notches would have been more apparent and general, increasing each time, and the distance showed until the entire cutting edge had been of itself cut off.

Consulting the laws governing plant or vegetable growth, we are told that all food before becoming fit for assimilation must be reduced to its gaseous state. If this be so, the question arises. How or by what methods of plant growth and assimilation is it possible for silica to appear in its original crystalline state among the tissues of the growing or matured tree, while it is universally known that this variety of wood grows only where this mineral is abundant in some of its modified forms? This, however, is not of great interest to manufacturers just how it gets there, but that it is present is shown conclusively. To get rid of it, even were it possible, would destroy the beauty and general characteristics of walnut, and to overcome its action on tools, rapid motion and softer iron is the best, safest, and most efficacious method.

LUMINOUS key hole trimmings and door knobs are said to be in great favor with the bibulous inclined person, and convenient for others. They are made of glass, and the back is covered with luminous paint, giving forth a light which may be seen considerable of a distance, on the darkest nights.

A Novel Method of Draining.

Recent experiments of Colonel John P. Fort, in southwest Georgia, in pond draining promise a revolution in the malarial sections of the South, which embrace the richest part of the country, and cover millions of acres. The great drawback of Florida, Louisiana, the rice sections of South Carolina and Georgia, has been the fact that white men could not live there on account of brackish drinking water, and malaria, inseparable from floods and swamps. Several years since, Colonel Fort, who owns much property of this description, conceived the idea of sinking artesian wells, holding that when a certain stratum was reached pure water could be obtained in abundance. His efforts were crowned with such success that every town in southern Georgia is sinking artesian wells. The water is perfectly clear, sweet, and pure as the best to be found in the highlands. This success led Colonel Fort to try the experiment of draining stagnant ponds by running them off through subterranean passages that are known to exist at a distance of from seventy to a hundred feet below the surface. Colonel Fort's experiment was made on his hickory level plantation, in Dougherty County, and the pond upon which he experimented is situated about two hundred yards from his pioneer artesian well. The pond covered an area of about two acres, with a depth of ten feet in the center. To drain it thoroughly an outlet must be made in the deepest part. To accomplish this Colonel Fort bound four substantial pieces of timber together, floated them over the center of the pond, and upon this foundation built his raft or pen, which sank as it was added to. When the raft had been built, the foundation resting on the bottom of the pond, the platform was across the top, and on this platform a derrick was set up. To this derrick boring apparatus was attached. At first a pile-driver was used, but when the pipe had been driven down through the bottom of the pond to a depth of thirty feet it rested on solid rock, and then the work of drilling and boring was begun. At a depth of fifty feet below the bottom of the pond the drill struck an opening, and at once the water commenced to sink with a roar through the big pipe, the top of which was only a few inches under water. The drill-pipe was drawn out, and the pond commenced to empty itself as fast as the orifice that the drill had made through the rocks would permit the water to flow. When the water in the pond was level with the top of the pipe a reamer was attached to the drill-pipe, and sent down to open the way for the big pipe to be sunk deeper. In this way the pipe was sunk until a joint of two sections was almost level with the bottom of the pond, and there it was unjointed. Colonel Fort will have a square pit dug around the pipe, and the pipe will then be driven down to a level with the bottom of this pit. The top of the pipe will be covered with wire to keep trash out, and the pit will be filled with rocks, and thus the drain will be kept open. This strange scene of emptying the pond into subterranean channels has been witnessed by hundreds of people, who see in it the reclamation of the millions of acres of swamp lands in the South. Thus, within two hundred feet of each other were two pipes, that of the artesian well throwing up the purest of drinking-water, and that in the middle of the pond sucking stagnant water into the bowels of the earth, and carrying it away. The experiment cost only $75, while there were gained from it over two thousand tons of compost soil.—*Boston Transcript.*

The Preservation of Buildings.*

BY DR. R. OGDEN DOREMUS.

In every case the architect must kneel at the shrine of chemistry. The chemist has been called upon by the architect to make an ink that will fade after twenty four hours; and on the other hand, an ink that will not become visible till after the lapse of twenty-four or forty-eight hours. The architect finds his work continually crumbling away. Water is the great solvent, especially with the addition of the acids always found in the atmosphere—carbonic, sulphuric, sulphurous, and nitric; besides ammonia, and often ozone. The coal burned in London alone disengages into the atmosphere 300,000 tons of sulphurous acid annually. These agents eat away brick and stone. Also water getting in and freezing is the great disintegrator in this climate. How to check this constant crumbling has been the great desideratum.

He demonstrated the porosity of sandstone by passing a jet of illuminating gas through a solid block of fine grained sandstone coated with about fifty coats of varnish, and covered on its sides with iron plates, leaving only a small area on each side unprotected, to which were applied pipes for the entrance and escape of the gas which was burned after passing through; and of fine Philadelphia brick similarly armed, by blowing through two thicknesses of it with force enough to extinguish the flame of a candle. He stated that gas will pass through stone not only without pressure, but even, as demonstrated by Prof. Chandler, *against* a pressure of ten to twenty atmospheres.

A result of porosity is that buildings after absorbing water effloresce, or become covered with a coating of salts, especially brick buildings laid in mortar made from sea sand. This means the decomposition of the material, besides a very disagreeable appearance. In Philadelphia, after a rain, the houses are generally thus whitened. This efflorescence cannot be prevented by ordinary paint nor oil.

Another dangerous result of porosity is that buildings absorb malaria. Hospitals thus become poisoned with a poison so deadly that he remarked he would sooner give his child the most deadly poison in the laboratory, and trust to the antidote, than expose him to such contagion.

He mentioned many well known buildings that were crumbling away, such as Girard College, the College of New York, Trinity Church, New York. He had dined with Gorringe soon after the obelisk was set up in Central Park, and the subject of the weathering of the obelisk was suggested. Gorringe said that it had stood 4,000 years, and would stand 4,000 years more. But, in fact, the obelisk is crumbling away. He showed several vials full of clippings collected at the foot of it, also specimens of stone found peeled off from inside the new capitol during the visit of the Institute to it in the afternoon.

A simple remedy was suggested, and one which has been extensively applied in St. Louis and to some extent in New York, namely, an application of paraffin mixed with a little creosote. The building is heated by a small furnace, and where there is ornamental work a blowpipe is sometimes required to heat depressions. The paraffin is then applied in a melted condition, and sinks in about a quarter of an inch, giving a beautiful and indestructible glossy finish, and rendering the material absolutely waterproof and air-tight. In reply to a question about fire, he said that a fire would only drive it in a little. It costs on an average about fifty cents a yard, and never needs to be applied a second time, as no chemical agent in the air or in the rain affects it at all. Even caustic potash does not unite with it, of which one has said that "those who invented sulphur for hell did not know caustic potash." If the application is made to marble that has been weatherbeaten, the marble should first be cleaned with steel brushes. Marble thus cleaned, however, unless treated with paraffin, soon becomes covered with a yellow stain, as appears on the building No. 50 Wall Street, New York.

Some of the buildings in New York which have been treated with paraffin are St. Mark's Memorial Church, houses 124-6 South Fifth Avenue; Huyler's, corner Eighteenth Street and Irving Place; and a house No. 18 East Fifty-fifth Street, in a brownstone row. Every house in the row except this has its doorsteps "with verdure clad," and the growth of such mosses is destructive to the building material. The paraffin method is confidently commended by Dr. Doremus as the very best ever used.

* Abstract of a paper read before the American Institute of Architects, at their eighteenth annual meeting, Albany, Oct. 22, 1884.

An Electric Eel Six Feet Long.

A very interesting addition has recently been made, says the *London Daily News*, to the Zoological Gardens in the shape of an electric eel—*Gymnotus electricus*. It is said to be nearly six feet in length, and must therefore be one of the very largest specimens of its kind.

Humboldt, when in the native home of this fish in and about the Rio Colorado, measured some that were 5 feet 5 inches in length; but though the Indians said there were larger, he himself saw none. The captive in Regent's Park is no doubt therefore a very big specimen, and there can be little doubt of its power. Humboldt thought that the Indians of the locality referred to had exaggerated ideas on this subject, but they no doubt had had practical experience, while the illustrious traveler seems to have prudently refrained from testing the matter, except in the case of an eel in a somewhat exhausted condition. He admits that it would be temerity to expose one's self to the first shocks of a large and strongly irritated gymnotus; and though he does not mention any case within his knowledge of any human life being lost by a shock from the fish, the mode of catching them adopted by the Indians seems to render it by no means incredible that, as some have asserted, this fish is capable of killing a man.

The Indians, it seems, are accustomed, when they want to catch gymnoti, to scour the country round for wild horses and mules, which they drive into the ponds where the fish are known to be; and so violent are the discharges of the pent-up lightnings to which these animals are exposed that, though they are not actually killed by electricity, they are so stunned and disabled that usually several of them are drowned. Humboldt once imprudently put both his feet on an electric eel just taken out of the water; and though he does not speak of it as a large one, he says he never experienced from a large Leyden jar a more dreadful discharge than he felt on that occasion. He was affected all day with a violent pain in every joint of his body.

Waste of Oil.

An old machinist, of nearly fifty years' experience, stated in his shop recently that he had run a countershaft, which he pointed out, on five drops daily of oil, the shaft being one and a half inches diameter and having three bearings in hangers. "Yet," he said, "that shaft has never squeaked." The shaft carried pulleys which drove a drilling lathe, a polishing and wood turning lathe, a small screw cutting lathe, and a grindstone. Most of the weight of these pulleys was between the two hangers on which he lavished two drops of oil a day. He kept his shaft level and in line. The belts pulled almost equally. The boxes were Babbitted. The shaft made about three hundred turns.

The experimenter said that he had tested oils as well as quantity. He believed in clear animal oil—whale or lard. He felt assured that good oil was wasted wherever drip pans were used, and he never used them. There is a text here for establishments to sermonize over, where the shaft bearings drip oil and the floors are soaked with it.

Gas from Paraffin Oils.

A paper on this subject was read before the Chemistry Section of the British Association, at their recent Montreal meeting, by Dr. Stevenson Macadam, F.R.S.E., of Edinburgh. In the course of it he said that for the last fourteen years he has devoted much attention to the illuminating values of different qualities of paraffin oils in various lamps, and to the production of permanent illuminating gas from these oils. His earlier experiments were only directed to the employment of paraffin oils as oils; and the results proved the superiority of the paraffin oils over vegetable and animal oils, especially for lighthouse service. His later trials, however, were mainly concerned with the breaking up of the paraffin oils into permanent illuminating gas; and the results formed the basis on which paraffin oil gas has been introduced into the lighthouse service of Great Britain, both for illuminating purposes and as fuel for driving the engines of the fog-horns. The following table shows the results of his investigations on the relative values of the crude, green, and blue oils:

	Crude.	Green.	Blue.
Gas per gallon, in cubic feet	98	102	127
Candle power ...	50	53	54
Light value of gas per ton of oil, given in pounds of sperm candles,	4494	4741	6044

Successful Employment of Vaccination for Yellow Fever.

Dr. Freire, of Rio Janeiro, in a recent letter to the *Sanitary News*, writes as follows:

In compliance with your request, I will give you an account of the chief points of interest connected with my studies on yellow fever. I can, of course, give you only a very brief summary, and for further information may refer you to my two memoirs—"The Cause, Nature, and Treatment of Yellow Fever" and "The Contagion of Yellow Fever." An extended report on all the theoretical and practical bearings of my researches is now in press, and a copy will be sent to you as soon as issued.

The method of culture which I have followed is Pasteur's. I withdraw blood, or any other organic liquid, from persons sick with yellow fever, or from the bodies of the dead, using the most scrupulous precautions, and introduce these liquids into Pasteur's flasks, previously sterilized, and containing a solution of gelatine or beef "bouillon." In these conditions the microbe develops abundantly, and becomes of itself attenuated by the action of the air, which filters through the tampion or amianthus with which the flask is corked. The purity of these cultures is demonstrated by microscopic examinations, of which you will find a good illustration in my memoir, "Experimental Studies on the Contagion of Yellow Fever."

The microbe appears in the form of little black points, like grains of sand (780 diameters); in the mature form it presents the appearance of round cells with an ash-gray or black rim, containing in their interior yellow and black pigment and some granulations which will be the future spores. These cells burst at a given moment, and pour out their contents, *i. e.*, the spores, the pigments, and a nitrogenous substance composed of ptomaines, which I have isolated not only from vomited matter, but also from the blood itself, and from the urine. The yellow pigment, being very soluble, produces the icteric infiltration of all the tissues by a sort of tinctorial imbibition which may go on even after death; the black pigment, as well as the detritus, resulting from the rupture of the cells being insoluble, is carried into the general circulation, and produces obstructions in the sanguine capillaries, whence the apoplectic symptoms so common in yellow fever and in the urinary tubules, whence the suppression of the urine, a very frequent and terrible symptom in this disease.

I have described this microscopic organism under the name of *Cryptococcus xanthogenicus;* its development resembling that of this genus of algæ.

After having demonstrated the contagious nature of yellow fever by experiments upon barndoor fowls (see my memoir), I made experiments in preventive inoculations, first upon animals and afterward upon men; I did not fear to do this, because a multitude of experiments upon animals had previously convinced me of the perfect safety of inoculation with attenuated cultures.

Up to this date I have vaccinated 450 persons, for the most part foreigners recently arrived. Freedom from yellow fever has been pronounced among those thus vaccinated, for they have passed through a quite severe epidemic, and only six deaths have occurred among the 450 vaccinated persons—that is to say, less than two in a hundred—while more than a thousand deaths have occurred among the non-vaccinated, the mortality of the non-vaccinated sick being about thirty to forty per hundred. Thus, if we take one hundred vaccinated persons, under the most favorable conditions as regards receptivity, we have only two deaths during the entire epidemic; if we take one hundred non-vaccinated sick, we have thirty to forty decedents, which gives a mortality fifteen times greater among the non-vaccinated. Even if the mortality were only ten times or five times less great among the vaccinated, the preventive measure would be worthy of adoption. The protective inoculation for charbon gives an immunity to one-tenth, and that of vaccination for small-pox guarantees an immunity to one-fifth, according to the calculations of Bousquet.

DR. DOMINGOS FREIRE,

Professor in the Faculty of Medicine of Rio Janeiro, President of the Central Junta of Public Hygiene.

ENGINEERING INVENTIONS.

A valve gear has been patented by Mr. John W. Taylor, of Pittston, Pa. It is a contrivance of a radially grooved rocking disk worked by an eccentric, with valve rod and shifting lever and connections, making a simple, variable cut-off and reversing gear with a single eccentric, and dispensing with the link motion commonly adopted for the purpose.

A rail chair has been patented by Mr. Samuel M. Beery, of Omaha, Neb. It forms a bearing for the ends of the rails and holds them together; it is formed in sections, each with a base plate projecting from the inner surface, and provided with pins, which pass into apertures in the rails held at their ends between the sections.

A derrick has been patented by Mr. Patrick Kelly, of Poughkeepsie, N. Y. The invention consists in the combination with the cross beam, braces, post, and carriage of a derrick, of sliding extension bars and their operating ropes, so the derrick can be readily secured in place and released, or moved forward and run back to a safe distance when a blast is to be fired.

A link motion for engine valves has been patented by Mr. Thomas J. Walden, of Lebanon, Ind. This invention covers a novel arrangement and construction of parts, by means of which the steam supply may be cut off or varied at will according to the load on the engine, also facilitating the starting of the engine, constituting a variable cut-off, and preventing waste of steam.

A gripping attachment for traction cable systems has been patented by Mr. Orlando H. Jadwin, of New York city. It may be closed upon the cable with a slight movement of the operating bar, and when the strain is on the attachment is pulled a little out of the normal line of the cable to avoid hammering against the pulleys, whether operated in a forward or backward direction.

A mechanical movement has been patented by Mr. Ira F. Monell, of Sugar Loaf, Col. It is adapted for use with an ore sizer, and to convert rotary motion into reciprocating, giving the pan quick backward and slow forward strokes, to cause the pulp to advance along ascending sieves, to enable the length of the stroke to be regulated at will, and with other novel features.

A water elevator has been patented by Mr. Albert Van Ness, of Lowell, Mass. It is for raising water from deep wells, and the driving shaft and drum carrying the hoisting rope are connected by three gear wheels, the intermediate one pivoted to a swinging hanger, and connected therewith by a spring held lever latch, with a trip spring, stop roller, and reversing wheel, so the motion of the drum may be automatically reversed.

A method of and apparatus for cutting channels in water ways has been patented by Mr. John Gates, of Portland, Oregon. It is practically a sluicing process, by directing a current of water forced back from a stern paddle wheel on shoal or bar, and covers a novel arrangement of the vessel to swing on a pivot at the bows, and be there held while the stern is swung from side to side. The same inventor has also patented a method and means for cutting submarine channels by the action of a harrow hauled over a bar or river bed assisted by the natural currents of the water way.

AGRICULTURAL INVENTIONS.

A hay rack has been patented by Mr. Robert Griswold, of Woody, Kan. The sills, cross bars, and side bars of an ordinary hay rack are provided with peculiarly constructed ends and sides to confine the hay while being transported, and allow the rack sides to be readily detached for convenience in unloading.

A cotton planter has been patented by Mr. Louis S. Flatau, of Pittsburg, Texas. I has a funnel-shaped hopper and axle driven by a worm and worm wheel, held erect by a stationary tube with flaring upper end, and carrying the furrowing plow, a screw in the stationary tube causing the seed to be fed out by the revolution of the hopper.

MISCELLANEOUS INVENTIONS.

A shoe fastening has been patented by Mr. Daniel T. Chambers, of Washington, D. C. It is a blind strap lace of two thicknesses, the under layer having eyelets along each of its edges adapted to be successively caught over projecting hooks on the edges of the slit in the shoe.

An incandescent electric lamp has been patented by Mr. James W. Benson, of North Adams, Mass. It is constructed with a spring pawl attached to the globe cap and engaging with ratchet teeth formed upon the outer surface of the insulating ring, so the globe will be locked against accidental displacement.

A seal lock has been patented by Mr. Owen E. Newton, of Fort Madison, Iowa. It is for locking freight car and other doors, and may be adapted for a spring key, or have a projection by which the bolt may be driven or a leaden shot may be used as a key, the construction having many novel features.

A vehicle wheel has been patented by Mr. George D. Smith, of Glenn Springs, S. C. This invention provides means for excluding dust and dirt from the wheel bearing, and means whereby the wheel may be readily taken apart for repairs, the rim being of such construction that it may be loosened and tightened at will.

A bottle for aerated and gaseous beverages has been patented by Mr. James Vidie, of Pantin, France. The bottle is made by first blowing the ball of metal in a polygonal mould, and then rolling the ball while distended by blowing in a second mould of cylindrical form, the improvement consisting in the process of manufacture.

An indicator lock has been patented by Mr. Thomas B. Ashford, of Clinton, N. C. A wheel is set to show a different number each time the lock is opened, to prevent the lock being opened and closed by an unauthorized person, the changes in numbers showing through an opening in the lock, and giving proof of its surreptitious opening.

A fire escape has been patented by Mr. Alexander J. Windmayer, of Fort Madison, Iowa. It consists of a tubular bag or chute with one end connected to a frame hinged to a truck, with a top cross bar having lateral extensions to rest against a window frame when the bag or chute is extended, the frame also being connected to the truck by jointed braces.

A fire escape has been patented by Mr. Sylvester A. Price, of Eureka, Kansas. A drum like device has attached to and wound upon it a lowering wire or rope, with means for attaching the device to the body of the person descending, and also means for controlling or regulating the descent, embracing novel construction and great simplicity of operation.

An automatic feed for printing presses has been patented by Mr. Andrew R. Bennett, of Utica, N. Y. This invention covers a construction to enable such presses as the Gordon oscillating, such as used in many job printing offices, to be fed by an entirely self-acting mechanism, so the press will require no attention except to supply it with the blank sheets in a pile.

A paper cutting machine has been patented by Mr. Robert Atherton, of Paterson, N. J. In combination with cutters or knives are devices for transmitting motion to them from a drum or roller revolved by the paper passing over it, to cut a roll of paper into bands or strips, as rapidly as the paper is rolled, without danger of tearing.

A machine for scraping and splitting cane has been patented by Mr. Edward M. Ellis, of Gardner, Mass. It has a series of feed rollers, with mechanism for scraping cane or rattan, with a knife for splitting the cane, with suitable centering devices to guide the cane in such manner that it passes precisely centrally through the scraping and splitting devices.

A barrel former has been patented by Mr. Thomas L. Lee, of Memphis, Tenn. This invention relates to former patented improvements of the same inventor, and consists in such peculiar construction and arrangement of parts as permit a barrel to be quickly made without skilled labor, different forms of barrels being provided for.

A floor clamp has been patented by Mr. Edward W. Holt, of Corinna, Me. The invention consists in a clamp operated by means of toggle bars, or bars arranged on the lazy tongs principle, the spurs being forced into the floor by the foot of the operator, and the clamp retained and prevented from slacking up while the boards are being nailed.

A combined ventilator and damper has been patented by Messrs. Franklin R. Hogeboom and Geo. O. Woolcocks, of Brooklyn, N. Y. This invention is intended to be applied in connection with the flues or pipes of stoves and furnaces, and consists in having a damper within that portion of the flue that enters the central portion of the ventilating register, with other novel features.

A plane has been patented by Mr. Charles H. Pike, of West Troy, N. Y. It is a wood plane with its stock in two parts, so as to be adjusted at any required angle with each other, to dress roughed out work to the required transverse curve as the plane is rocked axially while being passed backward and forward over the work, the faces of opposite parts of the stock resting on trued edges of the work.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

Name and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or mail, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter**, should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) C. E. R. asks (1) how to preserve the carapax of a turtle. The scales on the outside surface always peel off. What will prevent it from peeling? A. Rub the inside of the carapax with the preparation such as is used for stuffing birds or animals. This is made of camphor, 1 ounce; corrosive sublimate, 1 ounce; alum, ½ ounce; sulphur, 1 ounce; all finely powdered, and mix. It is then hung up in some loft to dry out, and finally varnished. 2. Please give recipe for a good varnish with which to varnish the turtle shell. A. Any good solid body varnish will do. French polishing varnish of a light color will be found most satisfactory. This varnish can be purchased from almost any store.

(2) C. E. W. writes: 1. I want to know how much water my engine is using, by card. I have Bacon's formula, which I need not quote; also Roper's method, viz., divide the constant number 859.375 by the M. E. P. and the terminal volume. I have worked up a card by both rules, and the results are very far apart. Which is right? I want to get hold of a general rule that is applicable to all kinds of engines, and one that is right. A. Bacon's is approximately correct, only there should be deducted from the weight of steam, as obtained from card, the weight of steam compressed by the piston, as this steam enters this cylinder at the next stroke, and hence is a portion of the steam by which the card of the succeeding stroke is produced. 2. What is the use of making the clearance a factor in a problem of this kind? Does not the terminal volume take cognizance of the clearance every time? A. No; the clearance space is a part of the space filled by the incoming steam, and in which the steam expands as in the cylinder. No correct comparison between the card produced and a theoretically correct card can be made without taking the clearance space into the account. 3. In compiling steam tables, eminent authorities differ widely. I have Haswell, but he does not agree with some other engineers. Where shall I find some standard facts about steam, something I can bet on? I want a good handy book on indicators, etc., one that ordinary brains can take in, and that means *sans* algebra. A. Regnault's table of the properties of steam is the standard generally accepted; you will find it in "Barrus on the Indicator;" "Goodeve on the Steam Engine" you will find a very useful book. For the uses of the indicator "Rray's 20 Years with the Indicator" will give you much information; also Steam Engine Indicator, by Le Van.

(3) M. C. W. writes: Can you recommend an article or how to prepare a substitute to represent the gas discharged from the burning anthracite coal? My trouble is a thickening of the mucous lining of the bronchial tubes of a non-inflammatory character; everything in the way of treatment has proved useless. A. The gases generated by the combustion of coal are principally carbon monoxide and carbon dioxide; both of which are poisonous. It may be that the oxygen treatment would relieve you, but under all circumstances it is both cheapest and best to consult some competent physician.

(4) A. L. asks for information for making an alloy of copper and aluminum Does it require a special flux for obtaining a good soft and ductile product? If so, what kind of flux? I have tried without flux, only covered with charcoal powder, and got the metal very brittle. Are blacklead crucibles to be used, or sand crucibles? A. Use sand crucibles with borax flux. Use only from 5 to 10 per cent aluminum. Melt the copper first, add the aluminum in small pieces. Stir with a charred stick of hard wood held in a small tongs. For large quantity, as a 25 to 50 pound melting, the plumbago crucibles may be used.

(5) G. W. L. asks (1) the best cement for a fish aquarium. A. Take equal parts finely ground litharge, fine white sand, and plaster of Paris by measure, and one part finely pulverized resin. Mix, thoroughly dry, make into a putty with boiled linseed oil to which a little drier has been added. Beat the mixture well, and let it stand 3 or 4 hours before using it. This makes a strong and durable cement for both fresh and salt water. 2. With what shall I paint the inside? A. Make a varnish of shellac and methylated spirits of wood alcohol with zinc white, thin enough to flow freely with a brush; paint quickly, for it dries at once. A small portion of gutta percha dissolved with the shellac gives a polish to the paint.

(6) E. N. asks how to make a good covering to steam boiler, to apply upon it like plaster or mortar, and avoid caloric radiation. A. Mix asbestos with a little clay and plaster of Paris dry. Then wet the mixture with water quickly, and put on boiler with a trowel. Mix in small batches, as the plaster of Paris sets quickly. Short cattle hair makes good felting treated above in place of asbestos. Chopped straw has also been used where nothing better is at hand.

(7) C. S. P. asks if there is any acid that will mix with oil. If so, what is it? A. Most of the essential oils are soluble in concentrated acetic acid.

(8) M. E. S. sends impressions of three coins, and desires to know what they are and their value. Also where a catalogue can be obtained. A. No. 1 is a Danish coin of no value. No. 2 is a U. S. token piece would sell for about 50 cents. No. 3 is a modern Greek coin of no value.

(9) J. J. A. asks the size boat to make for an engine 2½x3½ inches, and boiler that will furnish plenty of steam. A. 22 to 24 feet length, and 4 feet beam. Vertical tubular boiler, 25 inches diameter and 44 to 46 inches high.

(10) E. W. S. writes: Will you give me a receipt for an enamel or varnish that will adhere to a galvanized iron tank, and, when beer is heated in it to a temperature of 210° Fah., will neither taste the beer nor come off? A. There is nothing to our knowledge that is trustworthy for holding hot beer, but a clean, pure copper surface. If there is anything, it would have been discovered before this by the brewing community.

(11) H. L. S. asks: Will a bullet fired from a smooth bore have as much penetration for the same amount of powder as one fired from a rifled gun? Or, in other words, does the twirling of a bullet add to its power of penetration? A. Round bullets of the same weight, and with the same weight and quality of powder, also with equal length of barrel, are supposed to have the greatest range and penetration from the smooth bore. The rifling of guns is for accuracy of range, and for the purpose of giving elongated bullets a spinning motion, to prevent turning over as well as for accuracy of range. The twirling does not add to its power of penetration.

(12) J. G. G. asks how to make "Chinese cement" for leather and other articles. A. Chinese glue is made by covering shellac with strong liquid ammonia and shaking frequently until dissolved. The solution takes some time to form, and is facilitated by standing, placing the bottle (well stoppered) in a moderately warm situation, and briskly agitating it at intervals. Bleached shellac gives a lighter colored cement, but it is not considered as strong.

(13) C. N. S asks how to project on a screen the object through a microscope. I understand that it can be done very successfully, and I should like to know how to construct such an apparatus. A. You can project microscopic objects on a screen by using the microscope objective in exactly the same manner as a magic lantern tube is used, with proper illumination and a condenser for concentrating the light on the object; you would have no difficulty in projecting the objects.

(14) J. C. S. asks whether there are any small boats now running by means of chemical engines. A. We know of no boats in regular use which are driven by chemical engines.

(15) E. H. McF. asks how to make a soldering solution that does not contain any acid. A. Try oil, or a solution of resin in turpentine.

(16) J. H. C. asks how the direct and first shadow of an object can be diminished in size. A. Only by lenses.

(17) D. D. O. asks what kind, of varnish is used in the nitric acid process of etching designs on blades of razors, etc., and also how it is done. A. Asphaltum varnish or beeswax will answer your purpose. The varnish is put on with a brush and allowed to dry; the beeswax is applied by warming the steel and allowing it to melt on the surface.

(18) J. W.—Steam boxes are not generally painted; oil paints are soon decomposed. Would recommend you to try coal tar, such as is used for anchors and chains.

(19) G. S.—The ingredients used in putting together emery wheels vary with different manufacturers, and they keep the exact particulars to themselves. You might try this: A solution of pure gum in naphtha mixed with finely ground sulphur; thoroughly mix with emery, place in a mould, and subject to great pressure; then vulcanize by heating to nearly 300° Fah. See article on carbon points in SCIENTIFIC AMERICAN SUPPLEMENT, No. 98.

(20) R. H. K.—The French method of polishing is by using a piece of fine pumice stone and water; pass regularly over the work with the grain until the rising of the grain is down, then with powdered tripoli and boiled linseed oil polish the work to a bright face. This will give a very superior polish, but it requires considerable time.

(21) J. H. asks the best kind of round belt where a flat belt cannot be used; is there anything besides a wire or chain? A. It depends altogether on the use proposed and the size needed. Twisted leather and raw hide are good in some places, while for various purposes ropes might do. There is, however, a sort of triangular shaped built-up leather belt which may be made to convey a good deal of power.

(22) R. F. T. writes: Where is a common playing marble manufactory located, and what is its address? A. Marbles are all imported from Germany. There is no special house or houses that manufacture them. They are made in small quantities by the peasants, and sold to some commission house in the neighboring city.

(23) E. P. A. asks if jeweler's oil is made from jaw bone of porpoise. If it is refined, or as procured from the bone. What is it worth. A. Yes; it sells at 15 cents for a small bottle. We believe however that in reality most the oil so sold is obtained from the blackfish. Some 6 quarts of a very limpid oil sometimes called melon oil is obtained from that portion of the head which reaches from the spout hole to the end of the nose and from the top of the head to the upper jaw. This oil is said to have an unusually low congealing point, and to have no corrosive effect on metallic surfaces, and is specially prepared by a few firms in the U. S. as a superior lubricator for delicate mechanisms.

(24) M. L. asks what product or preparation is used for separating wool from dry sheepskins. It does not injure the skin at all. A. Sodium sulphide has of late been a good deal used for this purpose, but various other preparations of lime and lime with arsenic are used.

(25) A. P.—There are several so-called kid revivifiers, whose composition is only known to those who make them. Probably olive oil, egg yolk, and alum would make a good base to work from; we fancy most of the revivifiers actually lessen the life of the kid, but the above could not be injurious. Shoe and boot dubbings are principally mixtures of oil and tallow, and may be colored to suit. The best waterproof boot polishes are simply made waterproof by carrying so much oil as to fill the pores of the leather, and thus repel water. Any preparation for cleaning brown tops should be adapted to the leather, which may be of sheep, goat, or calf. Sod oil is mixed both with degras and tallow or other oils for currying purposes.

(26) W. M. M. writes: Will you please give me (1) directions for silvering looking glasses that are spotted. A. Clean the bare portion by rubbing it gently with fine cotton, taking care to remove any traces of dust and grease. If this cleaning be not done very carefully, defects will appear around the place repaired. With the point of your knife cut upon the back of another looking glass around a portion of the silvering of the required form, but a little larger. Upon it place a small drop of mercury; a drop the size of a pin's head will be sufficient for a surface equal to the size of the nail. The mercury spreads immediately, penetrates the amalgam to where it was cut off with the knife, and the required piece may now be lifted to the place to be repaired. This is the most difficult part of the operation. Then press lightly the renewed portion with cotton; it hardens almost immediately, and the glass presents the same appearance as a new one. 2. Also, how I can waterproof blue sample boxes so as to enable me to wash same when they become dirty. A. It will be necessary to waterproof the paper before the box is made. The operation consists in dissolving 8 ounces of alum and 3½ ounces of Castile soap in 4 pints of water, and 2 ounces of gum arabic and 4 ounces of glue separately in 4 pints of water; mix the solutions, heat slightly, dip in the single sheets, which hang up to dry. You might try coating the boxes with this mixture.

(27) J. M.—The known boiler explosions in the United States, for 1883, were 184, causing 263 deaths and 412 persons injured; of these 40 per cent were in saw mills, showing careless management in such establishments as a class. The above is somewhat larger than the average of previous years.

(28) T. E. L. asks the various methods of engraving, etc., names on door plates. A. The ancient and honorable way of engraving door plates is to draw the forms of the letters upon the plate with a steel point or even a pencil, and dig out the letters with a graver according to your fancy or design. A way of etching the letters with acid has been in practice. With a complicated design some very pretty work is done in this way. The next is machine engraving, one kind being done by a routing machine carrying an automatic tracer traversing a pattern. Of these engraving machines there are several in the market under various patents and otherwise, some as mere tracers, others as liners, while some claim universal work.

(29) E. J. N.—Boilers cannot burn that are kept clean and with water at full height. Oil is the most pernicious element that can be fed to a boiler; it gathers the sediment and forms oil cake, which settles upon the fire sheets, causing the iron to become overheated or burned. This is a most dangerous practice. A little soda added occasionally to the feed water will prevent oxidation from acid waters.

(30) J. H. H.—There is no cheap material known suitable for conveying vinegar. Rubber hose and pipes of oak are probably the cheapest that are good. Porcelain or glass tubing is the best, and if properly protected is the cheapest for durability.—Powdered borax scattered in the runways of roaches and ants is the best known remedy. Steaming is practiced in some places where a small jet can be used with high pressure, so as to blow the steam into their hiding places.

(31) L. W. writes: I have several pairs of fine elk horns, but being exposed to sun are considerably bleached. How can I restore the brown color, or can you name a stain that will produce a brown color? A. Soak the horns for 12 hours in a solution of manganese sulphate, then wash with sodium carbonate and on allowing to dry the color will change into the brown shade desired.

(32) E. C. asks how to make the glossy marking ink used for marking show cards. A. Marking ink generally consists of lampblack mixed thoroughly with sufficient turpentine to make it thin enough to flow from the brush. The addition of sugar, glycerine, or gum arabic will impart a gloss to the ink.

(33) J. C. asks what they stain oak with in the car shops in Altoona, Pa.; it is a dark silver color. A. An oak stain can be produced by mixing powdered ocher, Venetian red, and umber in size, in proportions to suit; or a richer stain may be made with raw sienna, burnt sienna, and Vandyke. A light yellow stain of raw sienna alone is very effective. To darken oak, strong coffee is sometimes used. To make it very dark, iron filings with a little sulphuric acid and water, put on with a sponge and allowed to dry between each application, is good.

(34) H. G. H. asks what solution of chemicals can be applied to wood to render it fireproof, or remove danger of fire from stove pipe in close proximity to it. A. Coat the wood with zinc chloride or soda silicate. Another paint used is a saturated aqueous solution of 3 pounds alum and 1 pound copperas, with which the wood is twice painted; after drying, a solution of copperas in which powdered clay is suspended is brushed over the alum layer.

(35) J. S. W. asks: What is a carbon reducing agent or material for molten metals? A. According to Greenwood, reduction is the process of separating the metal from its ore or its chemical combination. The substance effecting this separation or reduction is called the reducing agent. In the metallurgy of iron we have to reduce the iron oxide (which is the ore) to metallic iron. This is principally accomplished by the indirect action of the carbon contained in the fuel. So that the iron oxide is reduced to iron by the carbon taking up the oxygen from the ore, forming carbon dioxide, thus:

$$\underset{\text{iron oxide}}{2Fe_2O_3} + \underset{\text{carbon}}{3C} = \underset{\text{iron}}{4Fe} + \underset{\text{carbon dioxide.}}{3CO_2}$$

A carbon reducing material therefore is such a material (generally fuel, as coal, wood, etc.) that gives up its carbon to unite with substance with which the metal is combined, as crude ore, generally oxygen, as, in the case given, iron oxide or hematite.

(36) J. A. T. asks the necessary qualifications in order to pass an examination as mechanical engineer. A. A good draughtsman and experience in the construction of machinery are the principal points. A knowledge of the practical application of geometry and mathematics, with a fair knowledge of the history of mechanical science, are mediums of success.

(37) F. W. D. asks how to make a stain to apply on the bottoms of boots and shoes that will give them a hard and clean bright polish. A. The polish is different from the stain, and comes, after proper sammying of the leather, with the use of rub stock or hammer, and perhaps a little use of gum. Good stains are now furnished by the aniline dealers for either oak or hemlock or any immediate finish, and probably as cheaply as you could make one, but hemlock leather "acid" tanned will not usually take a permanent stain, the acid working through. Nearly every prominent manufacturer has some information he keeps secret in regard to staining bottoms, but we judge aniline colors will give the simplest way of reaching any desired stain.

(38) E. L. H. asks: Is there any method of removing tattoo marks from the human skin without leaving a scar? A. It is extremely improbable that tattoo remarks can be removed from the skin. A writer in the *Chemical News* has stated that if the tattooing is performed with some carbonaceous matter, the marks can be made to disappear by being first well rubbed with a salve of pure acetic acid and lard, then with a solution of potash, and finally with hydrochloric acid. Pricking with milk has also been partially effective in some cases.

(39) L. E. B. W. asks if water and glycerine mixed will answer for a hot water apparatus for house warming. A. Water mixed with from one to five per cent glycerine will be safe and proper for hot water circulation only for heating purposes. For generating steam you might be troubled with foaming and the formation of scale cake.

(40) J. W. S. writes: Is not the variation in brightness of the star Algol caused by the peculiar shape of that body? Is it not a disk, or more properly speaking lens shape, revolving so as to present first the edge and then the face toward the earth, and having a period of 5 days 17 hours and 35 minutes? A. The revolution of a disk upon its plane as an axis is a most unnatural phenomenon among planetary or stellar motions. The common opinion among those who have investigated the observed conditions of this variable star is that a planet of about two-thirds the diameter of the primary, and at a distance of about twice its diameter, is revolving about the primary in a plane coincident with our solar system, making a revolution in 68 hours 48 8 minutes.

(41) P. B. S.—Neptune and Uranus cannot be seen with the naked eye. You will not recognize them except as the faintest stars in a 2 inch telescope. Stars have no measurable diameters. Poor telescopes may give them a false diameter. The distance between Zeta and Delta Orion is about 3° 42'. The hourly ascension is reckoned from the visual equinox, and is turned into degrees by multiplying the hours and minutes by 15, divide the minute sum by 60, adding the degrees to the hour sum.

(42) J. P. C. asks for a device for polishing the edges of No. 28 iron suitable for taking solder; polished about an inch wide on the edge of sheets, to be done cheaply and rapidly. A. You may take the scale off, or polish sheet iron edges suitable for soldering, by passing a revolving emery wheel along the edges—the emery wheel to be mounted upon a swinging frame; or by dipping the edges of the iron in a shallow bath of hydrochloric acid 1 part, water 3 parts, for a half to 1 hour, or until the scale is removed; wash the sheet in warm soda and water to free it from acid, and tin the edge required to be used for soldering with a copper and soldering fluid. If there are a great many sheets to be done, and machinery not easily obtained, the cheapest way is to make a shallow sheet lead trough; make a frame to hold the sheets vertical, all large enough to set up 20 or more sheets at once, when the whole operation may be made continuous.

(43) H. S. writes: I noticed in the SCIENTIFIC AMERICAN of September 27, that citric acid was used in the preservation of meat, etc. But it stated also that the soluble citric acid could not be used, etc. Please state what kind of citric acid is used and in what manner and proportion, etc. A. Citric acid is a disinfectant both when in solution or as a solid, but combinations of the anhydrous acid with other elements than hydrogen are soluble, and cannot be used. For instance, such as sodium citrate, or iron citrate, etc., cannot be used. The proportion of acid used depends largely upon the substance with which it is used. The manner of employment is by mixing the solution of acid with the substance.

(44) P. T. H. asks: 1. Suppose a boat 36 feet long, 8 feet beam, 20 inches draught, what horse power of engine would be required to drive it six miles against the tide or a river current of two miles an hour? A. We think an engine 8 inches cylinder by 8 inches stroke would suit. 2. Is a long stroke or short stroke engine better for such boats? A. Short stroke preferable. 3. Would I gain much (on the coast), using such a boat mainly for pleasure, but sometimes for towing, by having masts and sails fore and aft the engine to be used on occasion? A. No. 4. Is one large or are two small propellers preferable, and what size in either instance, and about weight and cost of propellers? A. Two propellers better for towing, one for speed only; if one propeller, 3 feet 2 inches to 3 feet 4 inches diameter; if two, 34 inches to 36 inches diameter. 5. Is there any United States law which forbids a man to use a small steam launch or yacht, and to carry with him whoever goes of his own will, provided he does not carry freight or passengers for money? It is said that a license after inspection by a government official, iron bearing the government stamp, licensed engineers, pilots, or at sea navigators, etc., are required for boats driven by steam. What is the law? A. There is such a law; such licensed officers are required.

(45) W. F. McK. asks formula for pad for rubber stamp, called ever ready ink pad. A. The following is said to be a cushion that will give color permanently. It consists of a box filled with an elastic composition, saturated with a suitable color. The cushion fulfills its purpose for years without being renewed, always contains sufficient moisture, which is drawn from the atmosphere, and continues to act as a color stamp cushion so long as a remnant of the mass or composition remains in the box or receptacle. This cushion or pad is too soft to be self-supporting, but should be held in a low, flat pan, and have a permanent cloth cover. The composition consists preferably of 1 part gelatine, 1 part water, 6 parts glycerine, and 6 parts coloring matter. A suitable black color can be made from the following materials: 1 part gelatine glue, 3 parts lampblack, aniline black, or a suitable quantity of logwood extract, 10 parts of glycerine, 1 part absolute alcohol, 2 parts water, 1 part Venetian soap, one-fifth part salicylic acid. For red, blue, or violet, 1 part gelatine glue, 2 parts aniline of desired color, 1 part absolute alcohol, 10 parts glycerine, 1 part Venetian soap, and one-fifth part salicylic acid. The following are two additional receipts used for this purpose: 1. Mix and dissolve 2 to 4 dr. aniline violet, 15 ounces alcohol, 15 ounces glycerine. The solution is poured on the cushion and rubbed in with a brush. 2. Aniline violet 90 grains, boiling rain water 1 ounce; to which is added a little glycerine and a small quantity of treacle. The quantities of the last two ingredients will vary with the season, but half a teaspoonful will be ample for the quantities of violet and water specified.

(46) J. G. E. asks for (1) the best and cheapest way of dissolving corrosive sublimate—alcohol or glycerine—so that it will readily combine with linseed oil, and also with water. A. Corrosive sublimate can be dissolved in either alcohol or preferably in glycerine, and then mixed with the linseed oil; 58·96 parts of the corrosive sublimate are soluble in water at 212° Fah. 2. Also how to clarify and deodorize fish oil. A. Filter the oils through charcoal, or if that is impossible take 1,000 parts of the oil, 25 parts purified charcoal, and 10 parts calcined magnesia. Mix them carefully in a Courcineux vessel of glass or tinned iron, let it stand during three days with occasional agitation, and then filter through paper or felt. 3. Would a weak (aqueous) solution of corrosive sublimate do as an insecticide for a compost heap? And of what strength? A. Instead of corrosive sublimate, we would recommend the use of iron sulphate (copperas), or else a spoonful each of salt and lead nitrate, dissolved separately, and mixed in a pail of water.

(47) A. W.—Composition for ornamenting picture frames is made as follows: Dissolve 1 pound of glue in 1 gallon of water; in another kettle boil together 2 pounds of resin, 1 gill of Venice turpentine, and 1 pint linseed oil; mix all together in one kettle, and continue to boil and stir them together until the water has evaporated from the other ingredients; then add finely pulverized whiting till the mass is brought to the consistence of soft putty. This composition is hard when cold, but when warmed can be moulded to any shape.

(48) J. L. G. asks if blood albumen is still largely employed as a mordant in calico printing. Also is it imported to any large extent, what it is worth per pound, also the title of any work on the subject? A. Blood albumen is still extensively used in calico printing although not so, much as some years ago. Almost all of the albumen used is imported. It is manufactured to a slight extent in the West, at Chicago and other places where there is much slaughtering. Its price varies from 10 cents to 20 cents per pound, according to quantity. A. Klipstein, of 52 Cedar Street, and J. L. & D. S. Riker, of 45 Cedar Street, handle it. We know of no special book on the subject.

(49) A. M. P. asks for a receipt for ginger ale easily made. A. We take the following from our back files:

Brown sugar	2 pounds.
Boiling water	2 gallons.
Cream of tartar	1 ounce.
Bruised ginger root	2 "

Infuse the ginger in boiling water, and your sugar and cream of tartar; when lukewarm, strain; then add half pint good yeast. Let it stand all night, then bottle; if you desire, you can add one lemon and the white of an egg to fine it.

(50) L. C. writes: 1. I have made a Devinport writing desk of quartered sycamore; have oiled it, and given it body of white shellac. Please tell me through your Notes and Queries how I can give it a good polish. A. The French method of polishing consists in passing regularly over the work with the grain, using a piece of fine pumice stone and water, until the rising of the grain is down; then with powdered tripoli and boiled linseed oil polish the work to a bright face. This will give a very superior polish, but it required considerable time. 2. Is there anything poisonous about a lizard if taken into the stomach, by being boiled in water or otherwise? A. The flesh of certain lizards is considered a great delicacy, and is highly prized as an article of food in portions of South America.

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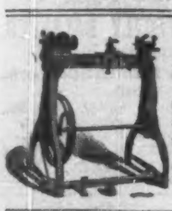

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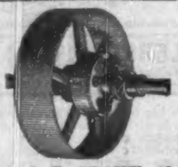

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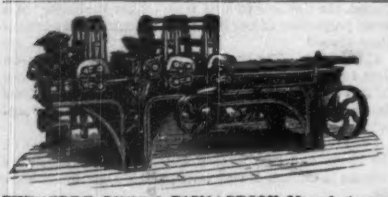

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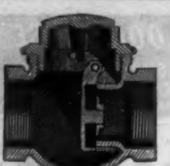

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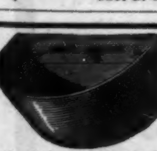

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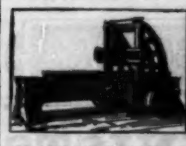

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